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# Public Health Reports

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## A SKIN REACTION IN RABBITS PRODUCED BY INTRADERMAL INOCULATION OF SUSPENSIONS OF KILLED *PASTEURELLA TULARENSIS*<sup>1</sup>

By CARL L. LARSON, Surgeon, United States Public Health Service

During the course of investigations concerning the immunity of various hosts against *Pasteurella tularensis*, skin tests were performed in rabbits utilizing antigens prepared from formalin-killed organisms. The aqueous phase, harvested after ether extraction of these crude suspensions, was also employed. Reactions occurring in rabbits, following intradermal injection of killed suspensions of *P. tularensis*, are described in this paper. The removal of a toxic principle from such suspensions by extraction with ether, and the neutralization of the skin reaction by immune serum is also discussed.

Giroud (1) demonstrated that rabbits reacted to intradermal injection of live typhus virus with production of a characteristic lesion, and that specific immune serum neutralized the ability of suspensions of rickettsiae to produce such lesions. Clavero and Gallardo (2), working with similar material, likewise concluded that the skin reaction was characteristic and that the serum-protection test was specific. The results obtained from the above studies indicate that a similar test may be of value in studying tularemia, a disease in which it has been extremely difficult to demonstrate protective antibodies in the serum of recovered individuals.

### MATERIALS AND METHODS

Fully virulent strains of *P. tularensis*, with the exception of strain No. 38 which was avirulent, were employed throughout the course of these experiments. They were grown upon the yolk sac of developing

<sup>1</sup> From the Division of Infectious Diseases, National Institute of Health.

chick embryos, employing the method of Cox, or upon glucose cystine blood agar. Infected yolk sacs were made into 10-percent suspensions in 0.85-percent salt solution, injected into mice intraperitoneally in serial tenfold dilutions to determine the infective titer, and killed by the addition of a 0.1-percent concentration of formalin.

Organisms grown on solid media were suspended in 0.85-percent salt solution or in 10-percent suspensions of normal yolk sacs in saline. The infective titer of the bacterial suspension was determined by intraperitoneal injection of serial dilutions into mice. The organisms in suspension were subsequently killed with 0.1-percent formalin. Ether extraction was carried out according to the method of Topping and Shear (8) after the pH of the bacterial suspensions was adjusted to 5.6.

Serums from human cases of tularemia and serums from rabbits and goats immunized with suspensions containing killed *P. tularensis* were employed. These contained agglutinins against *P. tularensis*. Control serums consisted of normal rabbit or human serum.

All animals were obtained from stock of the colony maintained at the National Institute of Health.

The antigens which are discussed in this paper are listed in table 1, which also presents certain other pertinent data. Antigen 2367 was derived from antigen 2366 by extracting the latter with ether and harvesting the resultant aqueous phase. Similarly, antigens 2371, 2377, and 2381 were derived from antigens 2370, 2376, and 2380, respectively.

TABLE 1.—Strains and preparations of *Pasteurella tularensis* employed

Antigen	Strain of organism	Virulence of organism	Culture medium	Suspension fluid	Extracted with ether	$LD_{50}$ (mouse)
HS.....	HS.....	Virulent.....	G.c.b.a. <sup>1</sup> .....	Saline.....	No.....	$1.4 \times 10^{-10}$ .....
SA.....	SA.....	do.....	do.....	do.....	No.....	$3.2 \times 10^{-10}$ .....
TV1.....	HS.....	do.....	do.....	do.....	No.....	$1.5 \times 10^{-10}$ .....
TV2.....	SA.....	do.....	do.....	do.....	No.....	$6.8 \times 10^{-9}$ .....
TV5.....	RHP.....	do.....	do.....	do.....	No.....	$3.2 \times 10^{-10}$ .....
2366.....	RHP.....	do.....	Yolk sac.....	do.....	No.....	$3.2 \times 10^{-9}$ .....
2367.....	RHP.....	do.....	do.....	do.....	Yes.....	.....
2370.....	RHP.....	do.....	G.c.b.a. <sup>1</sup> .....	Yolk sac.....	No.....	$1 \times 10^{-10}$ .....
2371.....	RHP.....	do.....	do.....	do.....	Yes.....	.....
2376.....	RHP.....	do.....	do.....	Saline.....	No.....	$1 \times 10^{-10}$ .....
2377.....	RHP.....	do.....	do.....	do.....	Yes.....	.....
2380.....	38.....	Avirulent.....	do.....	Yolk sac.....	No.....	.....
2381.....	38.....	do.....	do.....	do.....	Yes.....	.....
2398.....	RHP.....	Virulent.....	do.....	Saline.....	No.....	$1.5 \times 10^{-9}$ .....
2402.....	RHP.....	do.....	Yolk sac.....	do.....	No.....	$5.2 \times 10^{-10}$ .....
2406.....	SA.....	do.....	G.c.b.a. <sup>1</sup> .....	Yolk sac.....	No.....	$4.2 \times 10^{-9}$ .....
2410.....	SA.....	do.....	Yolk sac.....	do.....	No.....	$6.8 \times 10^{-9}$ .....
TV17.....	RHP.....	do.....	G.c.b.a. <sup>1</sup> .....	Saline.....	No.....	$3.2 \times 10^{-9}$ .....
TV17 EE.....	RHP.....	do.....	do.....	do.....	Yes.....	.....

<sup>1</sup> Glucose cystine blood agar.

## EXPERIMENTAL PROCEDURE AND RESULTS

*Description of the lesions.*—The lesions produced in rabbits by intradermal introduction of suspensions of formalin-killed *P. tularensis* varied to some extent depending upon the amount administered. With properly adjusted inocula, a constant type of lesion was produced which persisted for from 10 days to 2 weeks. No signs were noted at the sites of injection 8 hours after introduction of specific preparations, but definite redness and swelling were apparent within 18 to 24 hours. The height of the reaction was attained in 48 to 72 hours, and at this time the lesions were about 15–25 mm. in diameter and about 4–8 mm. in height (fig. 1). They closely resembled the primary lesion described in infectious myxomatosis of rabbits. The edges were sharp. In some instances, however, spreading was observed from the dependent edges of lesions located on the side of the test animal. The lesions were firm and appeared to be very edematous. Varying degrees of redness were apparent. In many instances central areas of necrosis were observed. The lesions began to fade slowly and by the end of the fifth day they were fairly dry. Pigmentation and scaling developed and persisted for a number of days.

Lesions identical with those in rabbits were also produced in guinea pigs by intradermal injections of the specific antigen. The skin of guinea pigs is thick and fibrous, and consequently it is difficult to perform intradermal inoculations. Rabbits were therefore routinely employed because of the ease with which the skin may be manipulated.

*Heat stability.*—Suspensions HS, 2402 SA, and 2410 were tested to determine the heat stability of the fraction capable of producing skin lesions in rabbits. Two cubic centimeters of each suspension was heated at 56° C. for 30 minutes in a water bath or submerged in a boiling water bath for a similar period in sealed ampoules. The unheated, heated (56° C.), and boiled suspensions were then injected intradermally into each of four rabbits, using 0.25 cubic centimeters of inocula. The boiled yolk-sac suspensions were coagulated, but by repeated aspiration into a syringe, to which a 24-gauge needle was attached, the particles of coagulated material were broken up. The lesion produced by intradermal injection of antigen heated to 56° C. did not differ from that produced by unheated antigen. In each instance, boiled antigen failed to produce a reaction when injected intradermally into rabbits (table 2).

*Sedimentation.*—Five cubic centimeters each of suspensions 2410 and HS was centrifuged for 30 minutes at 4,000 r. p. m. The supernatant fluid was carefully pipetted from the sediment and retained for subsequent testing. The remaining fluid was drained [of the sediment by inverting the centrifuge tube, placing the open end on

absorbent paper, and allowing it to drain for 15 minutes. The sediment was then resuspended to the original volume in salt solution

TABLE 2.—*Cutaneous lesions produced in rabbits by intracutaneous injection of 0.25 cc. of unheated, heated (56° C.), and boiled suspensions containing formalin-killed Pasteurella tularensis*

Treatment of antigen	Dimensions of lesions and degree of edema							
	Antigen 2410		Antigen 2402		Antigen SA		Antigen HS	
None	Dimension 26×20 mm.	Edema 3+	Dimension 20×19 mm.	Edema 3+	Dimension 30×20 mm.	Edema 2+	Dimension 28×15 mm.	Edema 1+
Heated (56° C.)	32×20 mm.	3+	26×22 mm.	2+	28×22 mm.	2+	26×23 mm.	1+
Boiled	I.B. <sup>1</sup>	----	I.B. <sup>1</sup>	----	Negative	-----	Negative	-----

<sup>1</sup> Residual lesion due to yolk sac.

containing 0.1-percent formalin. Rabbits were inoculated intracutaneously with 0.2-cc. amounts of the original suspension, supernatant fluid, and resuspended sediment. The supernatant fluids in general failed to produce lesions, whereas the sediments and the original suspensions produced typical reactions (table 3). The fraction responsible for production of skin lesions appears to be intimately associated with the bacteria.

TABLE 3.—*Cutaneous lesions produced in rabbits by intracutaneous injection of 0.2 cc. of whole suspension and of the supernatant and sediment obtained by centrifugation of suspensions containing formalin-killed Pasteurella tularensis*

Antigen	Centrifuged	Type of preparation	Dimensions of lesions and degree of edema			
			Rabbit 104		Rabbit 105	
2410	No	Whole suspension	Dimension 35×17 mm.	Edema 2+	Dimension 23×22 mm.	Edema 2+
	Yes	Sediment	25×23 mm.	2+	20×18 mm.	2+
	Yes	Supernatant	Negative	-----	15×12 mm.	0
HS	No	Whole suspension	12×12 mm.	1+	11×10 mm.	1+
	Yes	Sediment	12×10 mm.	1+	12×10 mm.	1+
	Yes	Supernatant	Negative	-----	Negative	-----

**Titration.**—Attempts were made to determine the minimal effective dose of the substance responsible for the dermal reaction, using the following suspensions: 2366, 2370, 2376, 2380, 2406, 2410, 2398, 2402, and HS.

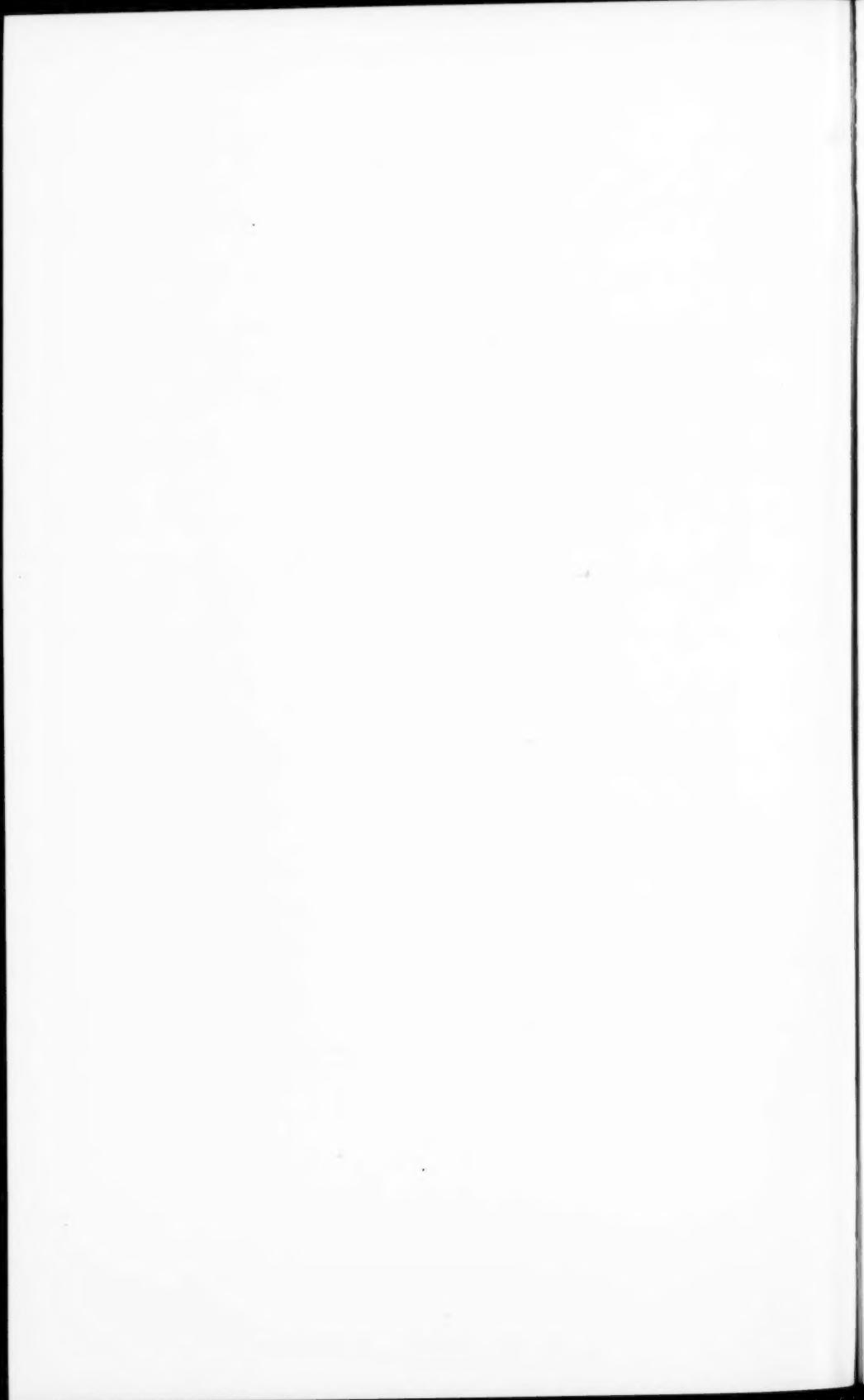
In one experiment, lots HS and 2410 were injected in 0.25-cc. amounts into the skin of each of two rabbits, using fourfold dilutions in an 0.85-percent salt solution. The results are given in table 4. The titers for these two antigens are in the neighborhood of 1:64 to 1:256. The end point of dermal activity is, in some measure, determined by the sensitivity of the test animal.

In a similar experiment in which nine other antigens containing suspensions of formalized *P. tularensis* were tested, the results obtained

PLATE I



FIGURE 1.—Skin lesions in a rabbit inoculated intracutaneously with 0.2 cc. of antigen TV17 in serial twofold dilutions. Lower left, undiluted antigen; upper right, antigen diluted 1:512 in salt solution.



showed that two antigens had titers of 1:8; two had titers of 1:16; four had titers of 1:32 or above; and one had a titer of 1:512 or greater.

*Ether extraction.*—The effect of extracting bacterial suspensions with ether was tested. A portion of a 10-percent suspension of yolk sacs infected with virulent *P. tularensis* and suspended in saline, preparation 2366, was extracted with ether and the aqueous phase, preparation 2367, was obtained. A portion of the aqueous phase was centrifuged for 30 minutes at 4,000 r. p. m. in an angle centrifuge and the supernatant fluid, preparation 2367T, was retained. A preparation consisting of a 10-percent suspension of normal yolk sacs in saline, preparation 14, was extracted with ether and the aqueous phase, preparation 14E harvested.

TABLE 4.—*Cutaneous lesions produced in rabbits by intradermal injection of 0.25 cc. of fourfold dilutions of suspensions containing formalin-killed Pasteurella tularensis*

Antigen	Dilution	Dimensions of lesions and amount of edema			
		Rabbit 106	Rabbit 107	Rabbit 106	Rabbit 107
2410.....	Undiluted.....	Dimension 20×18 mm.	Edema 3+.....	Dimension 30×30 mm.	Edema 3+.....
	1:4.....	20×17 mm.	3+.....	22×17 mm.	2+.....
	1:16.....	20×15 mm.	2+.....	10×10 mm.	1+.....
	1:64.....	15×15 mm.	1+.....	10×10 mm.	1+.....
	1:256.....	15×15 mm.	0.....	Negative.....	.....
	1:1024.....	Negative.....	.....	Negative.....	.....
	Undiluted.....	19×16 mm.	2+.....	20×16 mm.	1+.....
	1:4.....	20×15 mm.	2+.....	20×16 mm.	1+.....
HS.....	1:16.....	20×18 mm.	2+.....	15×15 mm.	1+.....
	1:64.....	20×18 mm.	2+.....	10×10 mm.	1+.....
	1:256.....	18×18 mm.	1+.....	Negative.....	.....
	1:1024.....	Negative.....	.....	Negative.....	.....

Sufficient organisms grown on solid media were added to various lots of preparation 14 so that the resultant suspensions contained approximately the same number of organisms as the infected yolk-sac suspension, preparation 2366. An avirulent strain of *P. tularensis*, strain No. 38, was added to the normal yolk-sac suspension and this was designated as lot 2380. A fully virulent strain of *P. tularensis* was added to the normal yolk-sac suspension to make lot 2370. The aqueous phase after ether extraction of lots 2370 and 2380 were designated as lots 2371 and 2381, respectively. A suspension of the virulent strain of organism in saline, which contained the same number of organisms as lot 2370, was prepared and designated as lot 2376. The aqueous phase after extraction was labeled as lot 2377.

All the above preparations were injected intracutaneously into two rabbits, each preparation in 0.2-cc. amounts and in duplicate. The results obtained are shown in table 5. Normal yolk sacs suspended in 0.85-percent salt solution failed to produce skin lesions in rabbits. Suspensions of infected yolk sacs and suspensions of normal yolk

sacs to which virulent or avirulent organisms had been added elicited reactions. Organisms grown on solid media and suspended in saline also produced lesions. Ether extraction of any of the above preparations destroyed their ability to produce such lesions.

TABLE 5.—*Cutaneous lesions produced in rabbits by intradermal injection of 0.2 cc. of ether-extracted and non-ether-extracted suspensions containing formalin-killed Pasteurella tularensis*

Antigen	Extracted with ether	Culture medium	Suspension fluid	Organ- isms present	Virulence of organ- isms	Dimensions of lesions and degree of edema	
						Rabbit 108	Rabbit 109
14.....	No.....		N. Y. S. <sup>1</sup>	0		Dimension	Edema
14E.....	Yes.....		do.....	0		2 x 2 mm.	0..
2366.....	No.....	Yolk sac.....		+	Virulent	Negative	Negative
2369.....	Yes.....	do.....		+	do.....	30 x 17 mm.	4+
2370.....	No.....	G. c. b. a. <sup>2</sup>	N. Y. S.....	+	do.....	25 x 21 mm.	4+
2371.....	Yes.....	do.....	do.....	+	do.....	25 x 21 mm.	4+
2376.....	No.....	do.....	Saline.....	+	do.....	Slight flush	Slight flush
2377.....	Yes.....	do.....	do.....	+	do.....	21 x 20 mm.	3+
2380.....	No.....	do.....	N. Y. S.....	+	Avirulent	12 x 10 mm.	2+
2381.....	Yes.....	do.....	do.....	+	do.....	Slight flush	Negative
						16 x 14 mm.	3+
						17 x 17 mm.	2+
						Slight flush	...

<sup>1</sup> Ten-percent suspension of normal yolk sacs in 0.85-percent salt solution.

<sup>2</sup> Glucose cystine blood agar.

We have been unable to demonstrate the presence of the toxic fraction in any of the phases resulting from ether extraction of yolk-sac or saline suspensions of organisms, although minimal lesions similar to those observed following intradermal injection of foreign materials occasionally occurred.

*Effect of immunization of rabbits upon skin reactions.*—A number of experiments was performed to determine the effect of immunization of rabbits upon the skin lesions produced by subsequent intradermal inoculation of specific formalized antigens. The effect was obscured in those experiments in which yolk-sac preparations were employed, since the animals became sensitized to egg materials. Antigens derived from cultures of *P. tularensis* grown on glucose cystine blood agar, killed with formaldehyde, and suspended in salt solution were then employed as the immunizing agent and as the skin-test factor. Antigens TV17 and TV17 EE were employed to immunize two rabbits. The rabbits were given 0.5, 1.0, and 2.0 cc. of each antigen intravenously on three consecutive days. One week after the last injection of antigen, these animals, together with two control rabbits, were inoculated intracutaneously with 0.2 cc. of 1:10 dilutions of antigens TV17 and TV17 EE. The results are shown in table 6. The lesions produced by antigen TV17 were smaller in the immunized animals than in the controls. No effect was demonstrated in the case of antigen TV17 EE, which produced minimal lesions in all animals, except for one control which developed no lesion. It would appear that immunization with the crude vaccine tends to decrease the size

of the skin lesion, but some sensitivity to subsequent intradermal injection of crude and ether-extracted antigens is maintained.

TABLE 6.—*Cutaneous lesions in normal rabbits and in rabbits immunized with crude and ether-extracted vaccines containing formalin-killed Pasteurella tularensis given intravenously in 0.5-, 1.0-, and 2.0-cc. amounts on three consecutive days*

Rabbit	Immunized	Antigens em-ployed	Dimensions of subcutaneous lesions and degree of edema			
			TV17	TV17EE	Dimension	Edema
A	No		24 x 20 mm.	2+	Negative.	
B	No		21 x 19 mm.	2+	6 x 5 mm.	hard nodule.
C	Yes	TV17	12 x 12 mm.	2+	9 x 6 mm.	hard nodule.
D	Yes	TV17	14 x 10 mm.	2+	5 x 5 mm.	hard nodule.
E	Yes	TV17 EE	12 x 9 mm.	2+	10 x 9 mm.	1+ edema.
F	Yes	TV17 EE	12 x 9 mm.	1+	5 x 5 mm.	hard nodule.

*Effect of immune serum upon skin reactions.*—A number of immune serums were tested to determine their effect on the ability of antigens to produce skin lesions in rabbits when the antigen and anti-serum were mixed and incubated prior to injection into rabbits. Serial dilutions of serum and suspensions of killed organisms were made in distilled water. Equal quantities of diluted serum and of the suspension of organisms were mixed and incubated at room temperature for 1 hour. The mixtures were injected intracutaneously into rabbits. Inocula of 0.2-cc. or 0.25-cc. amounts were employed. Each serum-antigen mixture was injected into each of two rabbits, which were also inoculated with a control mixture containing normal serum and antigen.

The results obtained are demonstrated in the following test with antigen TV5a. This antigen contained *P. tularensis* grown on glucose cystine agar. The organisms were suspended in saline and killed with 0.1-percent formalin. The serums employed were normal human serum, NHS; serum 28978, with an agglutination titer of 1:2560 against *P. tularensis*, obtained from a case of tularemia of recent origin; and serum V25, with an agglutination titer of 1:80 against *P. tularensis*, obtained from an individual presenting no history of tularemia but having a positive skin reaction to Foshay's skin-test antigen. The antigen was diluted 1:3 in distilled water and added to equal quantities of whole serum and to serial tenfold dilutions of serum in distilled water (1:5 to 1:5,000). Thus, antigen diluted 1:6 and serum diluted 1:2, 1:10, 1:100, 1:1,000, and 1:10,000 were present in the final mixtures. After incubation at room temperature for 1 hour, 0.2 cc. of each mixture was injected intracutaneously into each of two rabbits. The lesions observed were recorded at the end of 48 and 72 hours. The results are shown in table 7. The immune

serums definitely inhibited the production of skin lesions. The end point was not reached with serum 28978, and a definite inhibition was shown with serum V25 at a 1:10 dilution.

TABLE 7.—*The neutralization (by specific immune serum) of the ability of suspensions containing formalin-killed Pasteurella tularensis to produce cutaneous lesions in rabbits*

Serum	Agglutination titer against <i>P. tularensis</i>	Dimensions of lesions, degree of edema and dilutions of serums employed				
		1:2	1:10	1:100	1:1000	1:10000
		Rabbit 136				
NHS.....	Negative.....	{22×20 mm. 2+edema	21×19 mm. 2+edema	24×17 mm. 2+edema	26×18 mm. 2+edema	25×18 mm. 2+edema
28978.....	1:2560.....	Negative	Negative	Negative	Negative	Negative
V25.....	1:80.....	Negative	Negative	{21×17 mm. 1+edema	24×19 mm. 2+edema	24×15 mm. 2+edema
Rabbit 137						
NHS.....	Negative.....	{29×21 mm. 4+edema	22×20 mm. 4+edema	22×15 mm. 4+edema	23×17 mm. 4+edema	26×19 mm. 4+edema
28978.....	1:2560.....	Negative	Negative	Negative	Negative	Negative
V25.....	1:80.....	Negative	Negative	{19×11 mm. 1+edema	26×18 mm. 3+edema	24×22 mm. 4+edema

Further tests were made employing other serums. The results are tabulated in table 8. Inhibition of the skin reaction was observed with all serums obtained from cases which, by clinical and laboratory evidence, were cases of tularemia, and with serums from a human and a rabbit immunized against tularemia. No inhibition was apparent when normal rabbit serum or serum from cases of undulant fever was employed. There appears to be a general tendency for serums possessing the ability to inhibit skin lesions to possess also a high agglutina-

TABLE 8.—*The agglutination titers against Pasteurella tularensis and Brucella abortus and the neutralization titer against the capacity of suspensions containing formalin-killed Pasteurella tularensis to produce skin lesions in rabbits*

Serum	Source of serum	Agglutination titer versus		Neutralization titer	Remarks
		<i>P. tularensis</i>	<i>Br. abortus</i>		
7.....	Human.....	Negative.....	1:2560.....	Negative.....	Brucellosis.
76.....	do.....	do.....	1:320.....	do.....	Do.
73.....	do.....	1:320.....	Negative.....	1:2.....	Tularemia.
74.....	do.....	1:320.....	do.....	1:10.....	Do.
V25.....	do.....	1:80.....	do.....	1:10.....	Tularemia (remote).
HD.....	do.....	1:160.....	do.....	1:100.....	Vaccinated versus tularemia.
R2.....	Rabbit.....	1:320.....	1:10.....	1:100.....	Do.
BG.....	Human.....	1:1280.....	1:10.....	1:100.....	Tularemia.
71.....	do.....	1:1280.....	1:10.....	1:100.....	Do.
EV.....	do.....	1:1280.....	Negative.....	1:100.....	Do.
28109.....	do.....	1:1280.....	do.....	1:100.....	Do.
28972.....	do.....	1:10240.....	1:20.....	1:1000.....	Do.
G11.....	do.....	1:1280.....	Negative.....	1:10000.....	Do.
28978.....	do.....	1:2560.....	1:160.....	1:10000.....	Do.
28132.....	do.....	1:5120.....	Negative.....	1:10000.....	Do.

tion titer. This is not always the case, for some serums with low inhibiting power, e.g., serum 74, possess high agglutination titers and in some instances, e.g., serum 28972, the inhibiting power is lower than the agglutination titer. Studies are being made to determine the relation between the ability of serums to agglutinate *P. tularensis*, to inhibit the production of skin lesions in rabbits by specific antigens, and to protect rats against infection with *P. tularensis*.

#### DISCUSSION

The reaction described demonstrates the toxicity of formalized preparations of *P. tularensis* for the skin of rabbits. The degree of dermal reaction in normal rabbits is intense and closely resembles that which we have observed during the first 48 hours following the injection of living organisms into the skin of normal rabbits.

It had been previously demonstrated that ether-extracted vaccines are, to some degree, more antigenic than vaccines which are not treated in this manner (4). The results obtained in the present study show that ether extraction decreases the toxic effects of *P. tularensis* antigens as demonstrated by the reduction of the skin reaction in rabbits following intradermal injection of such antigens. These findings indicate that such vaccines should be extracted with ether before being used as immunizing agents.

The ability of specific immune serums to neutralize the skin-toxic factor demonstrates that such serums possess antibodies, developed during the course of immunization or infection, capable of neutralizing at least some portion of the antigenic complex of *P. tularensis*. Whether or not this capacity of immune serum is related to the protective ability of the serum is not as yet clear.

#### SUMMARY

Suspensions of *P. tularensis* grown on glucose cystine blood agar, suspended in 0.85-percent salt solution or 10-percent normal yolk-sac suspension, and killed with 0.1-percent formalin are capable of producing lesions when injected intracutaneously into normal rabbits.

Suspensions of *P. tularensis* grown on the yolk sacs of chick embryos, suspended in salt solution and killed with 0.1-percent formalin are capable of producing skin lesions in normal rabbits.

Skin lesions may be produced in normal rabbits either by fully virulent or avirulent strains of *P. tularensis*.

The skin-toxic fraction is not destroyed by heating at 56° C. for 30 minutes, but is destroyed by boiling for a similar period.

Ether extraction of antigens wholly or partially destroys the capacity of the toxic factor to produce skin lesions in normal rabbits.

Specific immune serum neutralizes the skin-toxic factor contained in formalized antigens.

Rabbits immunized with crude antigens containing killed *P. tularensis* apparently are capable of partially neutralizing the skin-toxic factor.

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#### DURATION OF TOXICITY OF SEVERAL DDT RESIDUAL SPRAYS UNDER CONDITIONS OF MALARIA-CONTROL OPERATIONS<sup>1</sup>

By FREDERICK L. KNOWLES, *Senior Biophysicist* and CLINTON S. SMITH, *Biological Aide, United States Public Health Service*

This study is concerned with the duration of toxicity of several DDT residual sprays, in relation to the length of the "malaria season," and under conditions of malaria-control operations. That a DDT residual spray applied to the inside walls and ceilings of houses is effective in killing *Anopheles quadrimaculatus* females resting in houses has been demonstrated by Knowles and Smith (1) and by others. Although Knowles and Smith showed that a DDT residual spray was effective up to the end of their study, a period of approximately 3 months, the limit of the duration of toxicity in relation to the "malaria season" and under conditions of malaria-control operations has not been clearly established. This information is of primary importance in planning and organizing a spraying program and in computing its total cost, because this information determines whether houses should be sprayed once, twice, or more often during the "malaria season."

For the purposes of this study, an area some 7 square miles in extent near the town of Hughes, Ark. was selected because it was typical of the Delta region, traditionally devoted to the culture of cotton, and because of the relatively large adult mosquito population. The area contained 115 houses, of which 18 were vacant and 97 were occupied by 90 white and 330 Negro men, women, and children. The houses were, in general, the conventional plantation type with little or no screening, and were of such construction and in such condi-

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<sup>1</sup> From the National Institute of Health, Office of Malaria Investigations, Memphis, Tenn.

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tion that screening alone would not have been a serious impediment to the access of mosquitoes.

Each occupied house was assigned a number. The numbers, divided into five groups, were marked on cards and placed in a container and thoroughly mixed. Cards were drawn from the container and the corresponding numbers on the card assigned to each house in the order in which they occurred, following the roads in a prescribed route.

For purposes of comparison, one group of houses was left unsprayed or was sprayed with a xylol-triton mixture to appease insistent demands. The four other groups were sprayed with four different formulations of DDT.

A 4-gallon open-head compressed-air sprayer fitted with 3 feet of xylol-resistant hose, a shut-off valve, spray wand, and a special nozzle was used for applying the spray. Specifications for this nozzle state that it shall give a flat 80-degree atomized spray with a delivery rate of 0.2 gallon per minute at a pressure of 40 pounds. For applying formula C, a nozzle giving a flat 50-degree atomized spray at the rate of 0.4 gallon per minute at a pressure of 40 pounds was used. The spraying was done by an experienced operator.

The four different formulas of DDT are tabulated in table 1, water having been added so that the applied spray contained approximately 5 percent DDT. Table 2 shows the number of houses in each group, the total wall and ceiling area sprayed, as well as the average per house, and the calculated deposition of DDT in milligrams per square foot.

TABLE 1.—*Ingredients and proportions of the four different formulas of DDT employed*

Ingredients	Formula A	Formula B	Formula C	Formula D
DDT	1 part	1 part	3.5 lb	1 part.
Xylol	3 parts	3 parts	10.5 lb	0.5 part.
Triton X100	0.25 part	0.25 part	0.9 lb	
Carbowax 400 <sup>1</sup>		0.35 part		
Paint			20 gal	
PD344C <sup>2</sup>				4 parts.
Water	17 parts	18 parts		16.5 parts.

<sup>1</sup> Produced by Union Carbon & Carbide.

<sup>2</sup> Produced by Socony Oil Co.

The walls and ceilings of 72 houses were sprayed during the period May 21 to June 6, when the first *A. quadrimaculatus* adults could be found in their usual daytime resting places. It is at this time that malaria transmission begins, and this period is therefore the beginning of what is called the "malaria season."

Inspections were made not only of the inside of sprayed and unsprayed houses but also under houses and in all outbuildings, in order

to indicate the extent of the mosquito population on the premises. Two inspectors, equipped with 5-cell focusing flashlights were employed. One inspector examined the inside of the house and under the house; the other, the outbuildings. No inspections were made before 10 a. m.

TABLE 2.—*Comparison of the five groups of houses*

Item	Formula				
	Unsprayed	A	B	C	D
Number of houses.....	25	22	20	10	20
Total area sprayed.....	45,170	41,845	16,420	43,465	
Average square feet per house.....	2,053	2,092	1,642	2,173	
Milligrams DDT per square foot.....	None	90.4	86.8	96.7	94.0

The first inspection was made approximately 4 weeks after spraying, the inspection period being from June 20 to July 3. Six complete inspections were made of practically all the houses in the five groups approximately 4, 6, 9, 12, 14, and 17 weeks, respectively, after spraying. At the time of the last inspection, September 19 to October 12, the weather had become cooler, and relatively few *A. quadrimaculatus* adults were found.

The results of the six inspections are tabulated in table 3, which gives for each inspection period and for each group of houses the actual number of mosquitoes found and the mean number of mosquitos per house.

The data has been arranged in table 4 to show the number of houses in both the unsprayed group and the combined sprayed groups which harbored 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 or more mosquitoes when inspected. Chi-square values calculated for each of the six inspection periods are 62.76, 58.71, 38.88, 44.40, 22.38, and 29.56, respectively. These values indicate a probability of less than 1 in 100 and are considered highly significant.

Also, comparison of each sprayed group with the unsprayed group for each inspection was made, and chi-square values were calculated. All four groups for the first four inspections gave chi-square values that indicated a probability of less than 1 in 100, except group C, which had a probability of about 2 in 100. Groups A, B, and D for the fifth and sixth inspections gave chi-square values for a probability of more than 1 in 100, but less than 5 in 100. Group C for the fifth inspection gave a probability of about 25 in 100, and for the sixth inspection, a probability of less than 10 in 100, but more than 5 in 100. All values, except for group C for the fifth and sixth inspections, may be considered statistically significant.

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TABLE 3.—Comparison of the mean number of resting Anopheles quadrimaculatus females found in the 5 groups of houses for the 6 inspection periods

Inspection-period dates, 1945	Average time in weeks since spraying	Unsprayed	Sprayed with formula indicated			
			A	B	C	D
June 21 to July 6	4	6.2	0.30	0.05	0.11	0.12
July 6 to July 20	6	7.4	0	.10	0	.05
July 26 to Aug. 10	9	5.3	.11	.20	.10	.20
Aug. 13 to Aug. 28	12	4.0	.17	.05	.10	.10
Aug. 28 to Sept. 18	14	3.4	.11	0	.11	.06
Sept. 19 to Oct. 12	17	1.6	0	0	0	0

## ACTUAL NUMBER OF MOSQUITOES FOUND

June 21 to July 6	4	123	6	1	1	2
July 6 to July 20	6	177	0	2	0	1
July 26 to Aug. 10	9	133	2	4	1	4
Aug. 13 to Aug. 28	12	91	3	1	1	2
Aug. 28 to Sept. 18	14	65	2	0	1	1
Sept. 19 to Oct. 12	17	33	0	0	0	0

## NUMBER OF HOUSES INSPECTED

June 21 to July 6	4	20	20	20	9	17
July 6 to July 20	6	24	20	20	10	20
July 26 to Aug. 10	9	25	18	20	10	20
Aug. 13 to Aug. 28	12	23	18	19	10	19
Aug. 28 to Sept. 18	14	19	18	17	9	17
Sept. 19 to Oct. 12	17	21	22	19	10	20

TABLE 4.—Distribution of houses according to the number of resting Anopheles quadrimaculatus females found in each house at each of the 6 inspections

Number of mosquitoes in house	Number of houses											
	First inspection, June 21 to July 6		Second inspection, July 6 to July 20		Third inspection, July 26 to Aug. 10		Fourth inspection, Aug. 13 to Aug. 28		Fifth inspection, Aug. 28 to Sept. 18		Sixth inspection, Sept. 19 to Oct. 12	
	Unsprayed	Sprayed	Unsprayed	Sprayed	Unsprayed	Sprayed	Unsprayed	Sprayed	Unsprayed	Sprayed	Unsprayed	Sprayed
0	2	58	5	68	6	60	7	59	10	57	13	71
1	1	6	2	1	4	6	4	7	4	4	6	0
2	4	2	1	1	3	1	4	0	2	0	0	0
3	4	0	2	0	1	1	2	0	0	0	0	0
4	2	0	3	0	3	0	2	0	0	0	0	0
5	1	0	2	0	1	0	1	0	1	0	0	0
6	0	0	1	0	1	0	0	0	0	0	0	0
7	2	0	3	0	0	0	0	0	0	0	0	0
8	0	0	1	0	1	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0
10 or over.	4	0	4	0	5	0	3	0	2	0	2	0
Total number of houses	20	66	24	70	25	68	23	66	19	61	21	71

**SUMMARY AND CONCLUSIONS**

To determine the duration of toxicity for mosquitoes of several DDT residual sprays, 72 houses were sprayed with 4 formulas of DDT spray at the beginning of the "malaria season," on about June 1, and were inspected at 6 different periods until October 1, 1945. Twenty-five unsprayed houses in the same area were inspected at the same time.

For the period of the "malaria season," in this region a period of 17 weeks, the once-sprayed houses harbored significantly fewer mosquitoes than the unsprayed houses.

Little difference was found in the duration of toxicity of the four formulas of DDT residual spray employed, except for the formula used in the houses in group C, which was statistically less effective 14 weeks after spraying.

**ACKNOWLEDGMENTS**

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**POTASSIUM AND SODIUM METAPHOSPHATES AS SOURCES OF PHOSPHORUS FOR ANIMALS<sup>1</sup>**

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Wartime demands for a larger production of livestock and poultry in this country have materially increased the phosphate requirement for feeding purposes (1). It is known that natural phosphate rock can be made satisfactory for animal feeding by various processes of defluorination (1), (2), (3). A considerable number of phosphate products thus prepared, either experimentally in pilot plants or in large amounts by the chemical and fertilizer industries, were studied

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<sup>1</sup> From the National Institute of Health, U. S. Public Health Service, and the Tennessee Valley Authority.

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in respect to their composition and solubility by Hill, Reynolds, Hendricks, and Jacob (3). The availability, for the nutrition of the rat, of the calcium and phosphorus in these defluorinated phosphates has been the subject of several reports (4), (5), (6). The report by Ellis, Cabell, Elmslie, Fraps, Phillips, and Williams (6), represents a pooled experiment from several laboratories. Bird et al. (7) published in 1945 a resumé of studies of phosphorus supplements for feeding chickens.

The experiments reported in this paper were undertaken to investigate further the availability to rats of selected potassium and sodium metaphosphate compounds of a crystalline type which might serve as a source of phosphorus for domesticated animals. In addition, experiments were conducted to determine the effect of oxalate and ferric ion upon the absorption of calcium and phosphorus in the presence of meta- and ortho-phosphate.

#### MATERIALS AND METHODS

*Plan of experiments and description of diets.*—The general method was to compare the amount of storage of calcium and phosphorus in young, rapidly growing rats fed selected metaphosphates with the amount of storage of these elements in litter mates of the same sex given orthophosphates of known availability. The basal phosphorus-deficient diet of Schneider and Steenbock (8) with minor modifications (4) was used. The Wesson salt mixture was altered to produce the desired phosphorus content and adjusted so as not to distort the calcium-phosphorus ratio (4). The experimental procedures, description of diet preparation, and methods of chemical analysis are identical with those presented and described in detail in a previous report (4). The total percentage and source of phosphorus in the experimental diets are shown in table 1. The basal diet contained 0.01 percent calcium to which was added 0.2 percent

TABLE 1.—*Total percentage and source of phosphorus in experimental diets*

Dietary source of phosphorus	Experiment No.—										
	I		II		III		IV		V		
	Diet 563	Diet 564	Diet 565	Diet 566	Diet 567	Diet 568	Diet 569	Diet 570	Diet 571	Diet 572	Diet 573
Basal diet.....	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.4
KH <sub>2</sub> PO <sub>4</sub> .....	0.12					0.12		0.12		0.12	
KPO <sub>4</sub> (fertilizer, crystalline).....		0.12									
KPO <sub>4</sub> (laboratory, crystalline).....			0.12								
CaHPO <sub>4</sub> .....											
NaPO <sub>3</sub> (Bakers, crystalline).....				0.114		0.114		0.114			
NaPO <sub>3</sub> (laboratory, amorphous).....										0.12	
Total.....	0.16	0.16	0.16	0.16	0.154	0.16	0.154	0.16	0.154	0.16	0.16

calcium as  $\text{CaCO}_3$ , with the exception that in diet 566 part of the calcium was derived from  $\text{CaHPO}_4$ .

*Description of crystalline and amorphous metaphosphates used.*—The crystalline potassium metaphosphate "fertilizer" used in experiment 1 was prepared by the Tennessee Valley Authority. It contained 26.6 percent  $\text{K}_2\text{O}$  and 55.6 percent  $\text{P}_2\text{O}_5$ ; the remaining constituents were oxides of silica, iron, and aluminum. The X-ray diffraction pattern shown in figure 1a was identical with a crystalline sample prepared from chemically pure chemicals in our laboratory and with a sample prepared from technical grade primary potassium orthophosphate by the United States Department of Agriculture.<sup>2</sup> The chemically pure potassium metaphosphate was prepared in the laboratory from chemically pure potassium dihydrogen orthophosphate by fusion at  $700^\circ \text{C}$ . in a platinum dish; it was then cooled and the resulting crystalline compound was ground for animal tests. The X-ray powder diffraction data of this compound is presented in the conventional manner in table 2. The physical properties of pure crystalline potassium metaphosphate, identical in X-ray diffraction pattern with the "fertilizer" mentioned above, have been investigated by Madorsky and Clark (9). They found it to be extremely insoluble in water (0.0041 gm. per 100 ml. at  $25^\circ \text{C}$ . when the solubility was checked at successive intervals over a 24-hour period). They concluded that hydrolysis to ortho- or pyro-forms in water is exceedingly slow at this temperature.

TABLE 2.—*X-ray powder diffraction data of crystalline potassium metaphosphate*

$d^1$	$I/I_o^2$	$d^1$	$I/I_o^2$	$d^1$	$I/I_o^2$
6.3	0.46	2.07	0.05	1.476	0.05
5.22	0.27	2.04	0.04	1.445	0.19
5.04	0.35	2.02	0.15	1.423	0.10
4.52	0.15	1.973	0.06	1.40	0.08
3.73	0.50	1.944	0.33	1.38	0.13
3.45	1.00	1.890	0.10	1.340	0.07
3.38	0.46	1.864	0.13	1.31	0.12
3.29	0.15	1.833	0.08	1.281	0.09
3.14	0.50	1.807	0.08	1.264	0.20
3.07	0.15	1.786	0.15	1.215	0.06
2.90	0.35	1.760	0.04	1.198	0.07
2.83	0.19	1.730	0.15	1.170	0.15
2.74	0.27	1.710	0.06	1.157	0.13
2.67	0.32	1.682	0.04	1.140	0.15
2.57	0.32	1.661	0.05	1.129	0.15
2.38	0.04	1.63	0.07	1.116	0.15
2.33	0.08	1.61	0.08	1.103	0.15
2.26	0.71	1.57	0.20	1.085	0.08
2.21	0.58	1.495	0.06		

<sup>1</sup>  $d$ =interplanar spacing.

<sup>2</sup>  $I/I_o$ =relative intensity of lines.

<sup>2</sup> Supplied by K. G. Clark, Plant Industry Station, Beltsville, Md.

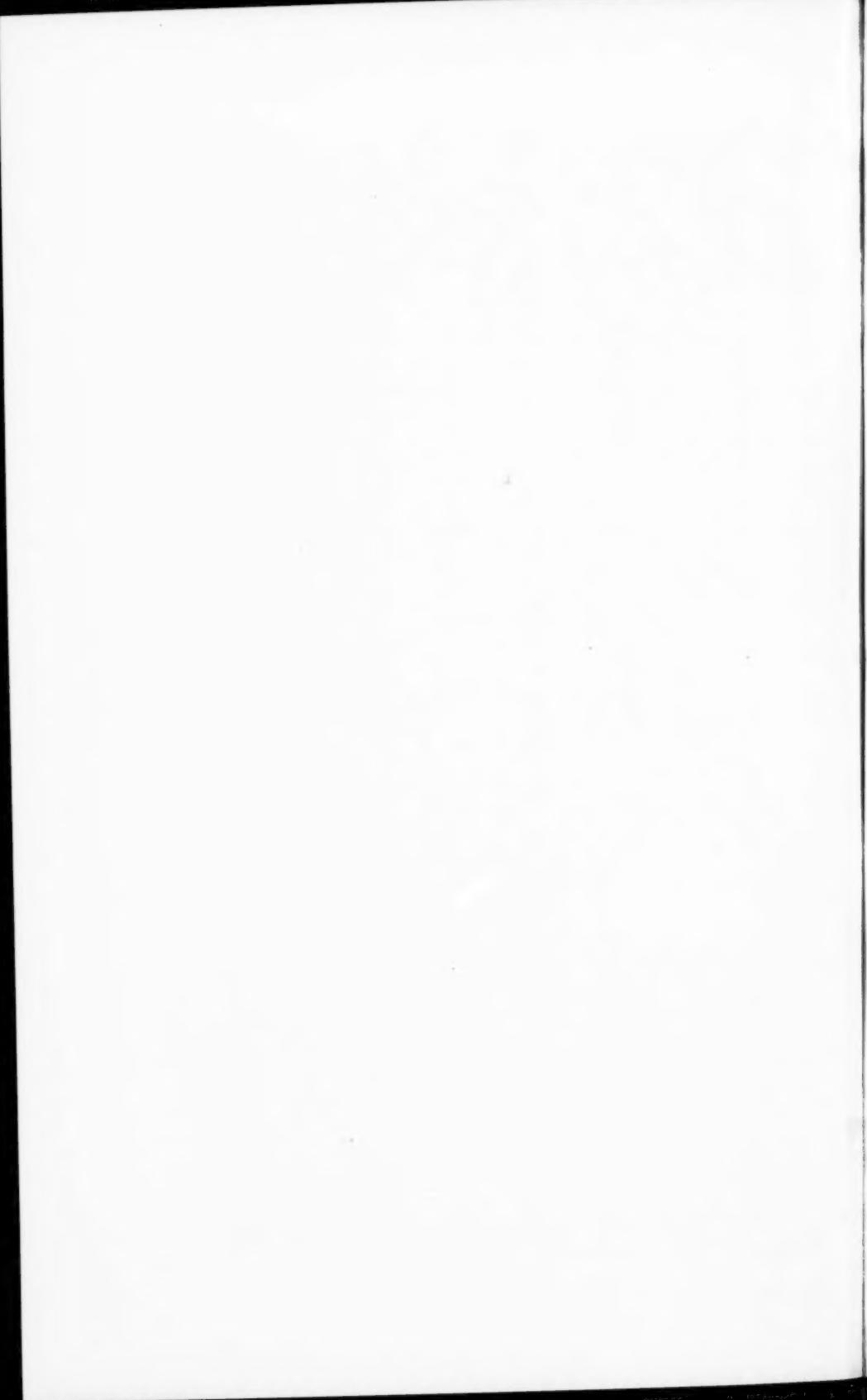


**FIG. 1a POTASSIUM METAPHOSPHATE FERTILIZER**



**FIG. 1b SODIUM METAPHOSPHATE**

FIGURE 1.



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The chemical company from which crystalline sodium metaphosphate was obtained stated that the  $\text{NaPO}_3$  was prepared by reacting  $\text{NaH}_2\text{PO}_4$  with  $\text{Na}_2\text{CO}_3 \cdot \text{H}_2\text{O}$  and  $\text{H}_3\text{PO}_4$ . An excess of  $\text{H}_3\text{PO}_4$  will produce an equivalent amount of  $\text{HPO}_3$ , and a deficiency of  $\text{H}_3\text{PO}_4$  will result in a corresponding increase in the amount of  $\text{Na}_4\text{P}_2\text{O}_7$ . The above mixture is concentrated by evaporation and then furnace at  $400^\circ \text{C}$ . A chemical analysis of this compound showed it to contain 28.86 percent phosphorus as compared to a theoretical value for  $\text{NaPO}_3$  of 30.38 percent. It is readily soluble in distilled water. The X-ray powder diffraction pattern showed the presence of  $\text{NaPO}_3$ , some  $(\text{NaPO}_3)_2$ , and another weak pattern which was not identified. (See fig. 1b.)

The amorphous  $\text{NaPO}_3$  was prepared in the laboratory by fusing chemically pure  $\text{NaH}_2\text{PO}_4 \cdot \text{H}_2\text{O}$  in a platinum dish at approximately  $700^\circ \text{C}$ ; it was then cooled rapidly so as to produce an amorphous, homogenous, glassy material which was finely ground for animal and chemical tests. This compound is also known as Graham salt and sodium hexa-metaphosphate; it is readily soluble in water. Karbe and Jander (10) demonstrated that it is quite rapidly hydrolyzed to the ortho-form in concentrations of hydrochloric acid which are similar to that of the gastric juice. Chemical analysis showed this preparation contained 28.9 percent phosphorus. The X-ray diffraction pattern showed that it was a completely amorphous compound.

#### EXPERIMENTS AND RESULTS

*Experiment 1.*—The object of this experiment was to compare the weight gain and calcium and phosphorus storage of rats which received orthophosphate in the form of  $\text{KH}_2\text{PO}_4$  with rats which received a crystalline metaphosphate in the form of a "fertilizer" prepared by the Tennessee Valley Authority and a crystalline chemically pure  $\text{KPO}_3$  prepared in the laboratory. The results, shown in table 3, demonstrate the poor availability of these crystalline metaphosphates as compared with the orthophosphates.

When the data on males and females are pooled, it appears that rats which received potassium orthophosphate stored 82 percent of the ingested phosphorus, whereas rats which received potassium metaphosphate stored only 46 percent of the ingested phosphorus. In respect to calcium retention, the orthophosphate was definitely superior to the metaphosphate, the averages being 70 and 19 percent, respectively. (In connection with these *in vivo* results, the extreme insolubility of crystalline potassium metaphosphate in distilled water is noteworthy.)

*Experiment 2.*—The purpose of this experiment was to compare the availability of a crystalline metaphosphate,  $\text{NaPO}_3$ , with an ortho-

TABLE 3.—Weight gain and calcium and phosphorus retention of rats receiving crystalline orthophosphate as compared with rats receiving crystalline metaphosphates. The effect of potassium oxalate and ferric citrate upon the retention of calcium and phosphorus when the dietary phosphorus was present in the orthophosphate and metaphosphate form

Experiment No.	Diet No.	Description	Sex	Number of animals	Average food intake (gm.)	Average weight gain (gm. $\pm$ S. E. M.) <sup>1</sup>	Calcium stored (percent of intake $\pm$ S. E. M.) <sup>1</sup>	Phosphorus stored (percent of intake $\pm$ S. E. M.) <sup>1</sup>
I	563	KH <sub>2</sub> PO <sub>4</sub> control.....	M	6	250	70±5.5	67±1.7	84±1.2
	564	KPO <sub>4</sub> fertilizer, crystalline.....	F	4	253	74±2.9	72±3.8	79±1.7
	565	KPO <sub>4</sub> C. P. crystalline.....	M	6	250	72±5.6	13±3.5*	43±2.3*
			F	4	251	66±4.3*	18±4.5*	47±4.2*
II	566	CaHPO <sub>4</sub> control.....	M	10	280	77±3.2	66±1.5	74±1.7
	567	NaPO <sub>4</sub> crystalline.....	F	7	262	64±2.9	70±2.0	65±2.9
			M	10	280	77±1.5	65±1.2	77±1.5
			F	7	262	57±3.6*	66±0.9	63±3.7
III	568	KH <sub>2</sub> PO <sub>4</sub> +K. oxalate.....	M	4	241	91±7.0	60±2.3	82±3.5
	569	NaPO <sub>4</sub> crystalline+K. oxalate.....	M	4	242	83±8.6	49±1.3*	77±2.0
IV	570	KH <sub>2</sub> PO <sub>4</sub> +Fe citrate.....	M	4	250	70±2.1	58±3.7	70±2.1
	571	NaPO <sub>4</sub> crystalline+Fe citrate.....	M	4	177	44±5.5*	6±2.5*	34±2.5*
V	572	KH <sub>2</sub> PO <sub>4</sub> +Fe citrate.....	M	4	-----	74±6.2	188±13	237±15
			F	5	-----	72±7.6	228±21	240±12
	573	NaPO <sub>4</sub> amorphous+Fe citrate.....	M	4	-----	41±2.5*	30±16*	73±14*
			F	5	-----	42±7.6*	10±12*	82±14*

\*The paired T test of Fisher (11) for significant difference between means was applied to the control and experimental groups in each experiment. An asterisk (\*) adjoining the S. E. M. value indicates that the difference between this group and the corresponding control group is significant by the T test, i. e., probability of such a difference occurring by chance is one in 20 times or less. If the weight gain was computed on the basis of percent weight gain based upon initial weight, the standard error of the mean in this column would be much less for most groups.

<sup>1</sup>S. E. M. = standard error of the mean (11).

<sup>2</sup>No record was kept of the food consumption in this experiment. Hence the calcium and phosphorus stored cannot be expressed in percent and must be expressed as amount stored, i. e., milligrams.

phosphate, CaHPO<sub>4</sub>. Table 3 shows no significant difference between the animals which received orthophosphate as compared to those which received crystalline metaphosphate in respect to availability of calcium and phosphorus. Crystalline NaPO<sub>4</sub> thus prepared is a good source of phosphorus for rats and does not adversely affect calcium retention. (The ready solubility of this crystalline sodium metaphosphate in distilled water is probably significant in connection with the *in vivo* results.)

*Experiment 3.*—The object of this experiment was to ascertain whether crystalline NaPO<sub>4</sub> would affect in any way the retention of calcium and phosphorus if the utilization of calcium was impaired by the presence of a high concentration of oxalate. To accomplish this purpose, the calcium content of the diet was retained at 0.21 percent and sufficient potassium oxalate was added to precipitate on a molecular basis 60 percent of the dietary calcium. Table 3 shows that 60 percent of the calcium ingested was retained by the rats which received the orthophosphate plus potassium oxalate, and 49 percent of the ingested calcium was retained by the rats fed

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the crystalline sodium metaphosphate plus potassium oxalate. In respect to phosphorus storage under these conditions, the animals fed orthophosphate stored 82 percent of the ingested phosphorus as compared with 77 percent by the animals fed metaphosphate.

*Experiment 4.*—The objective of the experiment was to ascertain whether crystalline  $\text{NaPO}_3$  would affect the retention of calcium and phosphorus in the presence of a high concentration of ferric ion. To accomplish this purpose, the calcium content of the diet was retained at 0.21 percent and sufficient ferric citrate was added to precipitate on a molecular basis all the dietary phosphorus. Table 3 shows that the controls which received orthophosphate plus ferric citrate retained 58 percent of the dietary calcium, whereas the rats which received crystalline metaphosphate plus ferric citrate stored only 6 percent of their dietary calcium. With regard to phosphorus retention, the corresponding percents for the ortho- and metaphosphate groups are 70 and 34.

*Experiment 5.*—This experiment was a repetition of experiment 4 except that amorphous  $\text{NaPO}_3$  replaced crystalline  $\text{NaPO}_3$ . Table 3 shows that when ferric citrate was added in equivalent amounts to diets 572 and 573, the animals which received phosphorus in the form of amorphous sodium metaphosphate stored only one-third as much phosphorus as those which received orthophosphate. The rats which received the metaphosphate were actually on a negative calcium balance. This is in accordance with the experiments of Day and McCollum (12). Their explanation is that young rats on a low phosphorus intake require phosphorus for growth of soft tissue; if a sufficient amount is not available in the diet it is mobilized from the bone. The associated bone calcium can no longer be utilized in the bone and, not being required in the soft tissues, it is excreted in the urine.

#### SUMMARY

1. A crystalline potassium metaphosphate prepared as a "fertilizer" and a chemically pure compound prepared in the laboratory were poor sources of phosphorus for rats.
2. A crystalline sodium metaphosphate was a good source of phosphorus for rats.
3. In the presence of sufficient oxalate ion to precipitate, on a molecular basis, 60 percent of the dietary calcium, orthophosphate was more effective than crystalline metaphosphate in promoting calcium retention. (This interpretation is based on experiments on four animals in each group.)
4. In the presence of sufficient ferric ion on a molecular basis to precipitate all of the dietary phosphorus, orthophosphate was much more effective than crystalline sodium metaphosphate and amorphous

sodium metaphosphate in promoting the retention of calcium and phosphorus.

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**CORRIGENDUM**

In the notice on the Australian Quarantine Requirement (Public Health Reports, vol. 61, No. 48, Nov. 29, 1946, p. 1737) "Australian quarantine measures" and "Australian Embassy" were incorrectly printed in the first paragraph as "Austrian quarantine measures" and "Austrian Embassy," respectively.

**DEATHS DURING WEEK ENDED NOVEMBER 16, 1946**

[From the Weekly Mortality Index, issued by the National Office of Vital Statistics]

	Week ended Nov. 16, 1946	Correspond- ing week, 1945
Data for 93 large cities of the United States:		
Total deaths.....	8,692	8,836
Average for 3 prior years.....	9,010	
Total deaths, first 46 weeks of year.....	414,560	411,700
Deaths under 1 year of age.....	723	594
Average for 3 prior years.....	613	
Deaths under 1 year of age, first 46 weeks of year.....	30,422	27,890
Data from industrial insurance companies:		
Policies in force.....	67,319,092	67,288,845
Number of death claims.....	10,008	10,767
Death claims per 1,000 policies in force, annual rate.....	7.8	8.3
Death claims per 1,000 policies, first 46 weeks of year, annual rate.....	9.4	10.0

## INCIDENCE OF DISEASE

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*No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring*

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### UNITED STATES

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#### REPORTS FROM STATES FOR WEEK ENDED NOVEMBER 23, 1946

##### **Summary**

A total of 366 cases of poliomyelitis was reported, as compared with 463 last week, 221 for the corresponding week of 1944, and a 5-year (1941-45) median of 158. Decreases occurred in all of the 9 geographic divisions except the New England and East North Central areas. Of 21 States reporting 5 or more cases and showing changes from last week's figures, 7 reported an increase (72 to 109), while 11 showed a decline (253 to 158). States reporting more than 9 cases currently are as follows (last week's figures in parentheses): *Increases*—Massachusetts 12 (9), Ohio 14 (5), Indiana 14 (6), Wisconsin 23 (18), Iowa 20 (11), Texas 20 (18); *decreases*—New York 32 (44), Illinois 37 (47), Missouri 14 (26), Kansas 12 (26), California 22 (28); *no change*—Michigan, 33, Washington, 11. The total reported since the approximate date of lowest seasonal incidence (March 15) is 23,790, as compared with 12,705 and 18,449, respectively, for the corresponding periods of 1945 and 1944 and a 5-year median for the period of 11,691.

Totals reported since the approximate date of lowest incidence are below last year's corresponding figures for diphtheria, influenza, measles, meningococcus meningitis, scarlet fever, smallpox, typhoid and paratyphoid fever, and whooping cough. The total cases of Rocky Mountain spotted fever reported to date this year is 564, as compared with 464 for the corresponding period last year, and for tularemia is 861, as compared with 664 for the same period last year.

Deaths recorded during the week in 93 large cities of the United States totaled 8,945, as compared with 8,692 last week, 8,537 and 8,477, respectively, for the corresponding weeks of 1945 and 1944, and a 3-year (1943-45) average of 8,593. The cumulative total is 423,505, as compared with 420,237 for the corresponding period last year.

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*Telegraphic morbidity reports from State health officers for the week ended Nov. 23, 1946, and comparison with corresponding week of 1945 and 5-year median*

In these tables a zero indicates a definite report, while leaders imply that, although none was reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45
	Nov. 23, 1946	Nov. 24, 1945	Nov. 23, 1946	Nov. 24, 1945	Nov. 23, 1946	Nov. 24, 1945	Nov. 23, 1946	Nov. 24, 1945	Oov. 24, 1945	Nov. 23, 1946	Nov. 24, 1945	Oov. 24, 1945
<b>NEW ENGLAND</b>												
Maine.....	4	3	2	.....	4	.....	185	1	2	0	0	0
New Hampshire.....	0	4	0	.....	.....	.....	56	.....	5	0	0	0
Vermont.....	0	0	0	.....	.....	.....	91	.....	3	1	0	0
Massachusetts.....	12	3	5	.....	.....	.....	190	110	110	1	2	4
Rhode Island.....	1	0	0	.....	.....	.....	60	1	2	1	0	1
Connecticut.....	1	0	0	1	.....	1	15	5	15	5	1	1
<b>MIDDLE ATLANTIC</b>												
New York.....	28	13	14	3	5	5	112	99	136	2	14	14
New Jersey.....	5	1	2	6	3	4	40	16	16	2	2	4
Pennsylvania.....	17	7	10	3	2	1	200	364	332	6	5	6
<b>EAST NORTH CENTRAL</b>												
Ohio.....	25	58	20	19	17	19	81	21	28	6	4	4
Indiana.....	18	16	15	5	284	4	9	3	13	2	5	1
Illinois.....	6	3	9	1	4	6	6	204	35	3	5	5
Michigan <sup>1</sup> .....	20	41	12	2	2	1	22	177	62	2	3	4
Wisconsin.....	9	1	1	7	94	19	58	16	38	1	0	1
<b>WEST NORTH CENTRAL</b>												
Minnesota.....	17	8	8	.....	.....	.....	8	4	5	4	2	2
Iowa.....	4	8	6	.....	.....	1	11	1	18	2	0	0
Missouri.....	6	9	9	3	4	4	2	32	7	2	7	1
North Dakota.....	0	1	6	.....	48	.....	1	3	3	0	0	0
South Dakota.....	0	2	2	.....	.....	.....	2	.....	2	0	0	0
Nebraska.....	2	0	5	11	25	.....	2	1	11	0	1	0
Kansas.....	7	7	6	1	1	1	10	18	18	4	0	0
<b>SOUTH ATLANTIC</b>												
Delaware.....	1	0	0	.....	.....	.....	.....	.....	1	0	0	0
Maryland <sup>2</sup> .....	7	19	11	4	5	5	12	5	16	0	0	1
District of Columbia.....	0	0	0	1	.....	1	1	1	2	0	0	0
Virginia.....	13	26	26	230	607	259	74	63	63	0	0	1
West Virginia.....	14	7	7	5	150	13	16	5	0	1	1	1
North Carolina.....	21	73	35	.....	.....	2	52	12	12	2	3	1
South Carolina.....	7	15	15	384	829	415	12	10	8	1	1	1
Georgia.....	4	22	21	20	26	28	49	1	3	2	0	0
Florida.....	12	3	8	2	6	2	6	4	8	1	0	0
<b>EAST SOUTH CENTRAL</b>												
Kentucky.....	16	12	10	.....	1	2	25	38	32	1	1	2
Tennessee.....	5	37	15	10	96	31	5	3	13	2	4	4
Alabama.....	9	30	23	42	150	54	9	1	3	0	1	1
Mississippi <sup>2</sup> .....	9	13	12	.....	.....	.....	.....	1	2	1	2	1
<b>WEST SOUTH CENTRAL</b>												
Arkansas.....	7	37	15	20	81	81	6	19	19	0	1	1
Louisiana.....	8	18	9	130	1	3	.....	3	1	0	1	0
Oklahoma.....	9	11	11	24	41	64	4	4	4	1	1	0
Texas.....	30	73	66	1,286	2,056	837	42	39	27	3	5	5
<b>MOUNTAIN</b>												
Montana.....	0	1	1	9	39	6	12	4	13	0	1	0
Idaho.....	1	3	0	21	14	1	1	127	8	1	0	0
Wyoming.....	2	0	0	5	45	18	6	4	7	0	0	0
Colorado.....	3	6	6	32	303	17	6	7	13	1	0	1
New Mexico.....	3	9	4	.....	3	2	27	3	3	1	0	0
Arizona.....	4	2	2	101	49	70	4	2	5	0	1	0
Utah <sup>2</sup> .....	0	0	0	1	225	3	11	21	21	0	0	0
Nevada.....	1	0	0	.....	.....	.....	.....	0	0	0	0	0
<b>PACIFIC</b>												
Washington.....	8	6	5	.....	1	16	218	15	0	1	1	1
Oregon.....	1	9	2	6	7	9	20	8	25	2	0	0
California.....	19	36	34	19	23	27	105	263	138	11	6	7
Total.....	396	653	435	2,404	5,240	2,465	1,682	1,936	2,464	74	81	93
47 weeks.....	14,462	16,163	13,851	209,166	97,820	98,408	651,631	115,850	566,993	5,332	7,395	7,395

<sup>1</sup> New York City only.

<sup>2</sup> Period ended earlier than Saturday.

<sup>2</sup> Delayed report: Meningitis, Maine, 1 case, included in cumulative total.

*Telegraphic morbidity reports from State health officers for the week ended Nov. 23, 1946, and comparison with corresponding week of 1945 and 5-year median—Con.*

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and para-typhoid fever <sup>4</sup>		
	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45	Week ended—		Median 1941- 45
	Nov. 23, 1946	Nov. 24, 1945		Nov. 23, 1946	Nov. 24, 1945		Nov. 23, 1946	Nov. 24, 1945		Nov. 23, 1946	Nov. 24, 1945	
<b>NEW ENGLAND</b>												
Maine	0	0	0	49	24	24	0	0	0	0	1	0
New Hampshire	4	0	0	1	2	13	0	0	0	0	0	0
Vermont	4	1	1	3	15	7	0	0	0	0	0	0
Massachusetts	12	7	4	73	104	170	0	0	0	4	2	1
Rhode Island	1	0	0	14	5	5	0	0	0	0	0	0
Connecticut	1	5	3	20	21	24	0	0	0	1	0	0
<b>MIDDLE ATLANTIC</b>												
New York	32	18	15	212	210	216	0	0	0	7	3	3
New Jersey	6	4	3	66	26	62	0	0	0	1	0	1
Pennsylvania	6	3	3	118	176	176	0	0	0	2	1	7
<b>EAST NORTH CENTRAL</b>												
Ohio	14	9	8	247	230	237	2	0	0	3	2	3
Indiana	14	1	1	82	59	59	0	3	1	2	2	1
Illinois	37	18	5	126	147	160	0	0	0	2	1	3
Michigan <sup>3</sup>	33	6	6	129	139	139	0	1	1	0	3	1
Wisconsin	23	12	3	83	63	111	0	0	0	1	1	1
<b>WEST NORTH CENTRAL</b>												
Minnesota	7	3	4	25	38	50	0	0	0	0	0	0
Iowa	20	2	1	23	44	52	0	0	0	1	0	0
Missouri	14	10	3	26	42	58	1	0	0	0	4	0
North Dakota	2	0	0	1	4	6	0	0	0	0	1	0
South Dakota	3	0	0	11	7	23	0	0	0	1	1	0
Nebraska	9	3	2	26	52	27	0	0	0	0	0	0
Kansas	12	1	2	32	59	70	0	0	0	2	3	1
<b>SOUTH ATLANTIC</b>												
Delaware	2	2	0	6	4	4	0	0	0	1	0	0
Maryland <sup>3</sup>	3	1	1	19	38	43	0	0	0	2	0	0
District of Columbia	1	1	0	6	12	21	0	0	0	1	0	0
Virginia	6	1	2	47	131	61	0	0	0	1	3	3
West Virginia	2	2	0	48	87	68	0	0	0	0	1	1
North Carolina	0	1	3	22	91	95	0	0	0	0	1	1
South Carolina	0	2	0	13	8	9	0	0	0	1	0	1
Georgia	3	1	0	13	42	42	0	0	0	0	2	1
Florida	3	1	1	10	2	9	1	0	0	0	2	2
<b>EAST SOUTH CENTRAL</b>												
Kentucky	0	0	2	52	50	57	0	0	0	3	3	3
Tennessee	3	7	3	26	79	84	1	0	0	2	0	3
Alabama	2	1	0	14	19	20	0	0	0	0	5	1
Mississippi <sup>3</sup>	2	2	2	9	22	21	0	3	0	0	1	1
<b>WEST SOUTH CENTRAL</b>												
Arkansas	8	7	0	5	20	15	0	0	0	1	0	2
Louisiana	3	4	0	4	14	7	0	0	0	2	0	3
Oklahoma	6	1	1	12	21	23	0	0	0	0	1	1
Texas	20	4	7	48	111	93	0	0	0	5	15	7
<b>MOUNTAIN</b>												
Montana	3	0	1	11	7	22	0	1	1	0	3	1
Idaho	2	0	0	8	6	6	0	0	0	0	0	0
Wyoming	0	0	0	1	3	3	0	0	0	0	0	0
Colorado	6	1	1	29	24	29	0	0	0	0	1	1
New Mexico	1	0	0	7	7	7	0	0	0	0	1	1
Arizona	0	1	1	8	12	5	0	0	0	0	0	1
Utah <sup>3</sup>	0	1	1	14	17	17	0	0	0	0	0	0
Nevada	1	0	0	1	2	1	0	0	0	0	0	0
<b>PACIFIC</b>												
Washington	11	7	5	39	34	34	0	0	0	0	1	1
Oregon	3	2	3	29	20	20	0	0	0	1	0	0
California	22	28	13	143	224	201	0	0	0	4	1	1
Total	366	174	158	2,011	2,574	2,642	5	8	11	50	66	70
47 weeks	24,256	13,102	11,993	102,994	159,167	124,926	324	320	687	3,785	4,597	5,155

<sup>2</sup> Period ended earlier than Saturday.

<sup>4</sup> Including paratyphoid fever reported separately, as follows: Massachusetts 4 (salmonella infection); Connecticut 1; Ohio 1; California 3.

<sup>3</sup> Corrections: Poliomyelitis, Maine, week ended October 26, 1 case (instead of 2); Arkansas, week ended November 9, 6 cases (instead of 5); Utah, 1 additional October case.

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Telegraphic morbidity reports from State health officers for the week ended Nov. 23, 1946, and comparison with corresponding week of 1945 and 5-year median—Con.

Division and State	Whooping cough			Week ended Nov. 23, 1946							
	Week ended—		Median 1941- 45	Dysentery			En- ceph- alitis, in- fec- tious	Rocky Mt. spot- ted fever	Tula- remia	Ty- phus fever, en- demic	Un- du- lant fever
	Nov. 23, 1946	Nov. 24, 1945		Ame- bic	Bacil- lary	Un- spec- ified					
<b>NEW ENGLAND</b>											
Maine	16	15	23								
New Hampshire	8										
Vermont	25	28	31							3	
Massachusetts	156	150	134				1			1	
Rhode Island	45	35	26							1	
Connecticut	64	42	70	1						1	
<b>MIDDLE ATLANTIC</b>											
New York	269	303	303	13	14					3	
New Jersey	175	140	140							1	
Pennsylvania	192	206	206	1	2				2		
<b>EAST NORTH CENTRAL</b>											
Ohio	89	154	154	1						1	
Indiana	31	17	18						3	6	
Illinois	93	143	143	10	3		3		2	11	
Michigan	226	142	222	2					3	7	
Wisconsin	177	90	172							9	
<b>WEST NORTH CENTRAL</b>											
Minnesota	6	19	41	5						1	
Iowa	14	7	12	2						25	
Missouri	30	3	16						1	1	
North Dakota	2		5								
South Dakota			3							1	
Nebraska	8	8	8								
Kansas	3	25	39	1					3	3	
<b>SOUTH ATLANTIC</b>											
Delaware	8		3				1				
Maryland	33	33	53				1				
District of Columbia	10	5	5								
Virginia	42	37	42			31			1	3	
West Virginia	15	30	17								
North Carolina	17	64	77								
South Carolina	38	55	31	5	10				5	1	
Georgia	13	5	5						2	10	
Florida	6		9							4	
<b>EAST SOUTH CENTRAL</b>											
Kentucky	13	42	42							1	
Tennessee	19	15	26	1					2	1	
Alabama	19	40	21							3	
Mississippi									1	2	
<b>WEST SOUTH CENTRAL</b>											
Arkansas	22	6	10		1		1		1		
Louisiana	5	1	3							5	
Oklahoma		12	8							1	
Texas	119	78	102	20	275	89			15	10	
<b>MOUNTAIN</b>											
Montana	1	2	16								
Idaho	1	11	3			10			1	1	
Wyoming	4		1								
Colorado	6	23	31		8						
New Mexico	4	16	4				1				
Arizona	15	1	4				23	1			
Utah	5	6	14								
Nevada		2	1								
<b>PACIFIC</b>											
Washington	7	53	32								
Oregon	7	8	8	1							
California	53	112	117	3	12		3			3	
Total	2,111	2,184	2,455	66	335	146	9	0	27	45	
Same week, 1945	2,184				37	276	94	8	2	14	
Average, 1943-45	2,102				34	486	81	9	2	10	
47 weeks: 1946	89,685				2,231	14,969	5,931	583	564	861	
1945	113,691				1,777	22,868	9,951	587	464	664	
Average, 1943-45	122,328				1,803	20,337	8,424	606	453	631	
										55	
										106	
										4,824	
										4,513	
										4,064	

<sup>a</sup> Period ended earlier than Saturday.

<sup>b</sup> 5-year median, 1941-45.

NOTIFIABLE DISEASES, THIRD QUARTER, 1946<sup>1</sup>

The figures in the following table are the totals of the monthly morbidity reports received from the State health authorities for July, August, and September 1946. These reports are preliminary and the figures are therefore more or less incomplete and subject to correction by final reports. In most instances they include cases reported in both civilian and military populations. The comparisons made are with similar preliminary reports; but, owing to population shifts and the presence of large military populations in certain States, the figures for some States may not be comparable with those for prior years, especially for certain diseases. Each State health officer has been requested to include in the monthly report for his State all diseases that are required by law or regulation to be reported in the State, although some do not do so. The lists of diseases required to be reported are not the same for each State. Only 11 of the common communicable diseases are notifiable in all the States. In some instances cases are reported, in some States, of diseases that are not required by law or regulation to be reported and the figures are included although manifestly incomplete. There are also variations among the States in the degree of and checks on, the completeness of reporting of cases of the notifiable diseases; therefore comparisons as between States may not be justified for certain diseases. As compared with the deaths, incomplete case reports are obvious for such diseases as malaria, pellagra, pneumonia, and tuberculosis, while in many States other diseases, such as puerperal septicemia, rheumatic fever, and Vincent's infection, are not reportable.

In spite of these known deficiencies, however, these monthly reports, which are published quarterly and annually in consolidated form, have proved of value in presenting early information regarding the reported incidence of a large group of diseases and in indicating trends by providing a comparison with similar preliminary figures for prior years. The table gives a general picture of the geographic prevalence of certain diseases, as the States are arranged by geographic areas.

Leaders are used in the table to indicate that no case of the disease was reported.

*Consolidated monthly State morbidity reports for July, August, and September 1946*

Division and State	Anthrax	Chick-enpox	Con-junctivitis	Diph-theria*	Dysen-tery, amebic	Dysen-tery, bac-terial	Dysen-tery, undi- fined	En-cephalitis	Ger-man ma- rivirus	Influ-enza	Mari-na	Meas-les*	Men-moen-geoc-cus*	Mumps	Oph-thalmia-neonato-rum	Pell-a-gra	Pneu-monia, all forms
<b>NEW ENGLAND</b>																	
Maine	150	27	1	1	1	1	1	50	11	17	17	364	7	240	23	92	4
New Hampshire	24	1	1	1	1	1	1	11	1	218	5	486	176	138	459	24	136
Vermont	120	10	104	10	11	11	1	74	1	80	80	3,138	16	15	15	15	42
Massachusetts	49	753	1	1	1	1	1	236	2	5	38	206	7	680	779	15	281
Rhode Island	20	9	3	3	1	1	1	59	1	7	58	779	15	1	1	1	1
Connecticut	261	11	11	11	1	1	1	1	1	1	1	1	1	1	1	1	1
<b>MIDDLE ATLANTIC</b>																	
New York	2	1,641	162	58	86	16	11	116	22	46	411	4,601	71	3,737	14	1,710	560
New Jersey	783	40	5	6	3	3	3	223	25	166	1,607	26	1,027	1	1	1	403
Pennsylvania	754	114	5	1	1	1	1	3	13	61	1,907	61	825	5	5	5	5
<b>EAST NORTH CENTRAL</b>																	
Ohio	595	113	67	3	3	5	5	132	10	84	2,134	40	806	156	395	225	750
Indiana	111	44	5	11	5	26	5	5	22	96	149	16	99	91	91	91	339
Illinois	870	85	62	11	9	9	9	68	15	111	651	49	337	571	571	571	467
Michigan	758	7	80	13	17	1	1	157	21	310	1,115	29	571	5	5	5	5
Wisconsin	1,196	60	60	5	1	1	1	257	8	121	2,326	15	1,607	1	1	1	1

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WEST NORTH CENTRAL			
Minnesota.	122	734	3
Iowa	84	28	16
Missouri	30	43	13
North Dakota	27	1	13
South Dakota	16	15	3
Nebraska	30	16	15
Kansas	56	81	15
SOUTH ATLANTIC			
Delaware	20	1	1
Maryland	82	79	5
District of Columbia	34	120	2
Virginia	152	1	1,152
West Virginia	44	38	1
North Carolina	52	121	2
South Carolina	20	39	15
Georgia	38	104	17
Florida	34	94	12
EAST SOUTH CENTRAL			
Kentucky	30	103	1
Tennessee	54	56	10
Alabama	14	103	13
Mississippi	482	106	372
WEST SOUTH CENTRAL			
Arkansas	20	63	29
Louisiana	26	72	39
Oklahoma	34	31	7
Texas	380	273	3,331
MOUNTAIN			
Montana	138	8	11
Idaho	35	2	7
Wyoming	18	7	4
Colorado	84	58	7
New Mexico	15	28	24
Utah	55	45	310
Nevada	319	4	1
PACIFIC			
Washington	207	112	5
Oregon	98	29	7
California	1,421	238	46
Total			
Total	2	133	3,085
Third Quarter 1945	18	12,291	132
Median 1941-45	18	13,629	13,304
Alaska *			
Hawaii Territory	29	139	4
Panama Canal Zone II	17	139	4

<sup>2</sup> See footnotes on page 1826.

## Consolidated monthly State morbidity reports for July, August, and September 1946—Continued

Division and State	Polio-myelitis*	Rabies in man	Rheumatic fever	Rocky Mountain spotted fever	Scarlet fever*	Septic sore throat	Small-pox*	Tetanus	Trachoma	Trichinosis	Tuberculosis, all forms*	Tuberculosis, respiratory forms	Tularemia	Typhoid fever, endemic	Vincent's infection	Whooping cough*		
<b>NEW ENGLAND</b>																		
Maine	16				146	5		4		1	129	120		11 27	13 23	5	152	
New Hampshire	123				57	21				89	61		5	5	3	70		
Vermont	22				23	9				7	840	789		1	25	4	187	
Massachusetts	172				432	25		2		7	103	95		95	79	2	1,580	
Rhode Island	54				38	4		1		2	240	230		7	3	1	287	
Connecticut	47				65	50				2				6		33	407	
<b>MIDDLE ATLANTIC</b>																		
New York	835				12	14 977		19		13	40	3,340	3,177		97	15	6	1,775
New Jersey	160	2			12	12 281		30	1	3	5	877	740		44	18	1	1,809
Pennsylvania	165				100	13		553		3	2	935	916		13 92	11 14	1	1,431
<b>EAST NORTH CENTRAL</b>																		
Ohio	494	3	17	8	807	4	4	7		8	1,267	740		1	74	13	1	32
Indiana	243			10	185	47	5	6		2	740	707		7	54	4	1	64
Illinois	1,706	2	58	34	412	30	1	9		9	1,029	916		7	40	6	1	124
Michigan	678		64		489	41				7	1,885	1,885		13 85	13 31	1		357
Wisconsin	919				354	68		2			512	512		2	7	1		107
<b>WEST NORTH CENTRAL</b>																		
Minnesota	2,461		11	2	167	90	2	2		1	7 526	6		13 16	13 10	5	150	
Iowa	381	6	9		127	10	1			1	190	190		3	6	1	163	
Missouri	894		1		106	16	1				581	581		15	31		27	
North Dakota	386				121	12					61	61		1	4		2	
South Dakota	316		1		21	4				2	80	80		5			15	
Nebraska	405				89						187	187		7	1		15	
Kansas	721	2			137	15	1			4	139	138		2	18	1		60
<b>SOUTH ATLANTIC</b>																		
Delaware	20		8		23						52	52		5			59	
Maryland	67	31	3		100	20		6			733	710		15		7	378	
District of Columbia	19				223	490				1	853	827		1	9		106	
Virginia	78				59						1,325	1,325		16	60	4	939	
West Virginia	49				8	220	3	1			570	570		2	26	2		21
North Carolina	67				45	212	11				1,043	1,043		11	22	2	36	304
South Carolina	8		76	2	25	5				1	565	559		1	34	2	17	1,050
Georgia	103	1	11	24	103	62				1	98	98		3	48	2	35	365
Florida	218				25						309	308		8	20	6	24	283

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EAST SOUTH CENTRAL		WEST SOUTH CENTRAL		MOUNTAIN		PACIFIC	
Kentucky	74	Tennessee	117	Alabama	251	Mississippi	207
1	1	153	11	153	5	108	1
1	1	43	23	43	5	74	1
1	1	12	11	11	7	11	7
1	1	25	11	25	6	11	6
Arkansas	280	Louisiana	231	Oklahoma	266	Texas	507
2	1	47	2	21	49	2	2
1	1	79	37	36	4	216	2
1	1	5	16	2	66	18	18
Montana	85	Idaho	27	Wyoming	105	Colorado	718
		1	14	1	2	10	50
		40	53	16	10	42	98
		16	66	6	1	1	1
New Mexico	127	Arizona	82	Utah	96	Nevada	11
		94	34	51	10	11	11
		1	1	72	1	11	16
Washington	270	Oregon	112	California	1,464		
		59	16	4	206	1	
		132	100	24	819	1	
		8	24	33			
Total	16,857	13	8,887	1,754	33	145	372
Third quarter 1945	8,275	6	1,211	344	164	300	86
Median 1941-45	8,186	6	234	12,988	2,031	151	121
Alaska	1	Hawaii Territory	4	Panama Canal Zone			

See notes on page 1826.

## FOOTNOTES FOR TABLE ON PAGES 1822 TO 1825

\* Diseases marked with an asterisk (\*) are reportable by law or regulation in all the states, including the District of Columbia. Typhoid fever is reportable in all the States; paratyphoid fever in all except 6 States. Syphilis is reportable in all the States and the District of Columbia, but is not included in the table.

<sup>1</sup> For reports for first and second quarters of 1946, see pp. 836 and 1336 of the PUBLIC HEALTH REPORTS for June 7 and Sept. 13, 1946, respectively.

<sup>2</sup> Includes cases of kerato- and staphylococcal conjunctivitis and of pink eye.

<sup>3</sup> In a few States, practically all contracted outside the Continental United States.

<sup>4</sup> Lobar pneumonia only; figures for some diseases for New York City include supplemental reports not included in previous quarters.

<sup>5</sup> Includes 1 case acquired through blood transfusion.

<sup>6</sup> Includes delayed reports.

<sup>7</sup> Corrected figures for Alaska for the second quarter of 1946: Chickenpox 63, diphtheria 2, German measles 18, Influenza 84, measles 67, mumps 37, pneumonia 23, septic sore throat 8, tuberculosis (all forms) 36, tuberculosis (respiratory) 76, tularemia 1, Vincent's infection 2, whooping cough 5.

<sup>8</sup> On shippping.

<sup>9</sup> Includes the cities of Colon and Panama.

<sup>10</sup> In the Canal Zone only.

<sup>11</sup> Includes cases reported as "salmonella infections."

<sup>12</sup> Includes septic sore throat.

<sup>13</sup> For 2 months only.

The following 11s includes certain rare conditions, diseases of restricted geographical distribution, and those reportable in or reported by only a few States; last year's figures in parentheses (where no figures are given, no cases were reported last year):

<sup>14</sup> Actinomycosis: Minnesota 1 (3).

<sup>15</sup> Coccidioidomycosis: New Mexico 1 (1), California 7 (3).

<sup>16</sup> Dengue: South Carolina 1 (8), Florida 1, Mississippi 1 (10), Texas 4 (7).

<sup>17</sup> Diarrhea: New York 26, New Jersey 19 (1), Pennsylvania 1, Ohio 383 (835) (includes enteritis); Illinois 48, Michigan 1 (2), Maryland 25 (74), South Carolina 2, 434 (4,429).

<sup>18</sup> Florida 15 (9), Montana 1, Idaho 1, Colorado 5 (1), Oregon 5 (4) (includes enteritis), California 11 (19), Alaska 2.

<sup>19</sup> Dog bite: Illinois 4,080 (3,278), Michigan 2,646 (2,713), Arkansas 133 (121).

Favus: <sup>20</sup> New Jersey 2.

Filariasis: New Jersey 1 (1). Food poisoning: Maine 82 (2), New Mexico 2, Washington 16 (71), Oregon 3, California 30 (89).

Granuloma (unspecified): Ohio 2 (19).

Granuloma inguinale: Missouri 3 (6), Florida 63 (69), Tennessee 30 (18), Mississippi 150 (177), Louisiana 73 (75).

Impetigo contagiosa: New York 22, Ohio 12 (2), Indiana 19 (10), Illinois 17 (11), Michigan 200 (200), North Dakota 4 (3), Kansas 16 (15), Montana 13 (24), Idaho 25 (2), Wyoming 11, Colorado 3, Nevada 48 (32), Washington 179 (117), Hawaii Territory 7 (18).

Jaundice (including hepatitis and Well's disease): Maine 1 (4), New York 67, Pennsylvania 4, Indiana 5 (2), Illinois 11 (102), Michigan 7 (2), Minnesota 20 (21), Nebraska 2, Kansas 2, Maryland 2, Florida 3 (1), California 69 (66).

Leprosy: New York 1, Illinois 1 (1), Louisiana 2 (3), Texas 6, Hawaii Territory 9 (3).

Lymphocytic choriomeningitis: Massachusetts 2 (2), Tennessee 6 (10).

Lymphogranuloma venereum: Missouri 9 (12), Florida 66 (63), Tennessee 32 (27), Louisiana 24 (45), Utah 4 (3), Nevada 1.

Puerperal septicemia: North Carolina 1, Mexico 1, Nevada 1, Florida 1 (1), Tennessee 3, Mississippi 55 (29), New Mexico 1, Nevada 1.

Rabies in animals: New Hampshire 1, Massachusetts 1, New York 320 (116), Ohio 284 (172), Illinois 80 (104), Iowa 19 (15), Missouri 7 (6), Kansas 2 (4), Maryland 2 (8), South Carolina 34 (19), Florida 7 (2), Alabama 135 (188), Arkansas 36 (33), Louisiana 11 (14), Texas 229 (190), Colorado 2, Utah 4 (1), California 72 (95).

Rat bite fever: Tennessee 1.

Relapsing fever: Texas 1 (9), Idaho 1, Nevada 2 (14), California 8 (3).

Ringworm: Pennsylvania 116 (214), Ohio 17 (4), Indiana 168 (9), Illinois 113 (240), Michigan 2 (200), Minnesota 81 (92), Iowa 24, Missouri 1 (4), Kansas 1 (1), Montana 1, Idaho 30, Wyoming 1, Washington 91 (45).

Seasickness: Pennsylvania 103 (14), Ohio 3, Michigan 123 (103), Missouri 3 (2), Kansas 10 (11), Maryland 2 (28), Montana 9 (33), Idaho 12 (10), Wyoming 1, Nevada 30 (20).

Silicosis: New Hampshire 2, Idaho 2 (1), New Mexico 2 (2).

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WEEKLY REPORTS FROM CITIES<sup>1</sup>

City reports for week ended Nov. 16, 1946

This table lists the reports from 85 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

Division, State, and City	Diphtheria cases	Encephalitis, infections, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
	Cases	Deaths	Cases	Deaths								
<b>NEW ENGLAND</b>												
Maine:												
Portland	0	0		0		0	3	0	6	0	0	1
New Hampshire:												
Concord	0	0		0		0	0	0	0	0	0	0
Vermont:												
Barre	0	0		0		0	0	0	0	0	0	0
Massachusetts:												
Boston	4	0		0	10	1	1	7	17	0	0	32
Fall River	0	0		0		0	1	0	0	0	0	0
Springfield	0	0		0	14	0	0	0	1	0	0	17
Worcester	0	0		0		0	3	2	2	0	0	33
Rhode Island:												
Providence	0	0	1	0	2	0	3	1	6	0	0	26
Connecticut:												
Bridgeport	0	0		0		0	0	0	1	0	0	0
Hartford	0	0	1	0		0	1	1	1	0	0	0
New Haven	0	0		0	5	0	0	0	2	0	0	5
<b>MIDDLE ATLANTIC</b>												
New York:												
Buffalo	1	0		0		0	2	1	7	0	0	4
New York	13	0	10	0	24	4	60	30	46	0	1	38
Rochester	0	0		0		0	2	0	6	0	0	0
Syracuse	0	0		0		0	1	2	6	0	0	12
New Jersey:												
Camden	2	0		0		1	2	0	0	0	0	9
Newark	0	0	1	0		0	4	0	4	0	0	21
Trenton	0	0		0	2	0	4	0	0	0	0	0
Pennsylvania:												
Philadelphia	2	0	3	0	2	2	20	2	33	0	0	31
Pittsburgh	0	0		0	110	2	6	0	17	0	0	4
Reading	0	0		0		0	3	0	0	0	0	8
<b>EAST NORTH CENTRAL</b>												
Ohio:												
Cincinnati	3	0		0	10	3	5	1	10	0	0	5
Cleveland	1	0	6	0	37	1	9	2	17	0	0	21
Columbus	3	0	1	1	1	0	2	0	21	2	0	10
Indiana:												
Fort Wayne	0	0		0	4	0	3	0	0	0	0	0
Indianapolis	2	0		2		0	7	2	9	0	0	27
South Bend	0	0		0		0	0	0	3	0	0	0
Terre Haute	0	0		0		0	0	0	2	0	0	0
Illinois:												
Chicago	1	0		0	7	0	26	15	33	0	0	48
Michigan:												
Detroit	8	0		0	8	0	16	6	40	0	0	53
Flint	0	0		0		0	1	2	1	0	0	12
Grand Rapids	0	0		0	1	0	2	1	4	0	0	6
Wisconsin:												
Kenosha	0	0		0		0	0	1	4	0	0	0
Milwaukee	0	0		0	12	1	5	2	1	0	0	127
Racine	0	0		0	2	0	0	1	5	0	0	1
Superior	0	0		0		0	0	1	1	0	0	0
<b>WEST NORTH CENTRAL</b>												
Minnesota:												
Duluth	1	0		0		0	1	3	4	0	0	2
Minneapolis	1	0		3		0	1	2	12	0	0	0
St. Paul	0	0		0	2	0	0	0	3	0	0	5
Missouri:												
Kansas City	0	0		0		0	5	4	5	0	0	0
St. Joseph	0	0		0		0	0	0	0	0	0	0
St. Louis	7	0		0		1	9	10	11	0	0	4

<sup>1</sup> In some instances the figures include nonresident cases.

*City reports for week ended Nov. 16, 1946—Continued*

Division, State, and City		Diphtheria cases		Influenza		Measles cases		Meningitis, meningococcus, cases		Pneumonia deaths		Scarlet fever cases		Smallpox cases		Typhoid and paratyphoid fever cases		Whooping cough cases	
		Diphtheria cases	Encephalitis, infectious, cases	Cases	Deaths	Cases		Meningitis, meningococcus, cases		Pneumonia deaths		Polioymelitis cases		Scarlet fever cases		Smallpox cases		Typhoid and paratyphoid fever cases	
WEST NORTH CENTRAL—continued																			
Nebraska:		0	0	0	2	0	4	0	7	6	0	0	0	0					1
Omaha.....		0	0	0	2	0	4	0	7	6	0	0	0	0					1
Kansas:		2	0	0	0	0	0	0	2	1	0	0	0	0					0
Topeka.....		2	0	0	0	0	0	0	2	1	0	0	0	0					0
Wichita.....		1	0	0	0	0	0	0	0	6	0	0	0	0					0
SOUTH ATLANTIC																			
Delaware:		0	0	0	0	0	0	0	0	2	0	0	0	0					7
Wilmington.....		0	0	0	0	0	0	0	0	2	0	0	0	0					7
Maryland:		4	0	1	1	4	2	0	2	9	0	0	0	0					38
Baltimore.....		4	0	1	1	1	0	0	2	9	0	0	0	0					38
Cumberland.....		0	0	0	0	0	0	0	0	0	0	0	0	0					0
Frederick.....		0	0	0	0	15	0	0	0	0	0	0	0	0					0
District of Columbia:																			
Washington.....		0	0	0	0	2	0	8	1	7	0	0	0	0					4
Virginia:																			
Richmond.....		0	0	0	0	16	0	1	4	5	0	0	0	0					3
Roanoke.....		1	0	0	0	1	0	0	0	3	0	0	0	0					0
West Virginia:																			
Charleston.....		0	0	0	0	0	0	0	0	0	0	0	0	0					0
Wheeling.....		0	0	0	0	1	0	0	0	1	0	0	0	0					1
North Carolina:																			
Raleigh.....		0	0	0	0	0	0	0	0	0	0	0	0	0					3
Wilmington.....		0	0	0	0	0	0	0	0	0	0	0	0	0					0
Winston-Salem.....		0	0	0	0	24	0	2	0	3	0	0	0	0					2
South Carolina:																			
Charleston.....		0	0	6	0	5	0	1	0	0	0	0	0	0					0
Georgia:																			
Atlanta.....		0	0	4	1	0	0	3	0	3	0	0	0	0					1
Brunswick.....		0	0	0	0	0	0	1	0	0	0	0	0	0					0
Savannah.....		0	0	0	0	9	0	1	0	0	0	0	0	0					0
Florida:																			
Tampa.....		3	0	0	0	0	0	3	1	2	0	0	0	0					0
EAST SOUTH CENTRAL																			
Tennessee:																			
Memphis.....		1	1	0	0	3	1	7	3	3	0	0	0	0					2
Nashville.....		1	0	0	0	0	0	2	1	1	0	0	0	0					2
Alabama:																			
Birmingham.....		0	0	1	0	0	0	1	0	4	0	0	0	0					1
Mobile.....		3	1	3	0	0	0	0	0	0	0	0	0	0					1
WEST SOUTH CENTRAL																			
Arkansas:																			
Little Rock.....		0	0	0	0	0	0	1	0	0	0	0	0	0					0
Louisiana:																			
New Orleans.....		5	0	1	1	3	4	6	12	4	0	0	2	0					5
Shreveport.....		1	0	0	1	0	0	2	0	0	0	0	0	0					0
Texas:																			
Dallas.....		2	0	0	0	1	0	2	0	2	0	0	0	0					2
Galveston.....		0	0	0	0	0	0	0	0	2	0	0	0	0					0
Houston.....		1	0	0	0	0	0	6	6	1	0	0	0	0					0
San Antonio.....		0	0	2	0	2	0	2	2	2	0	0	0	0					4
MOUNTAIN																			
Montana:																			
Billings.....		0	0	0	0	0	0	0	0	0	0	0	0	0					0
Great Falls.....		1	0	0	0	2	0	1	0	0	0	0	0	0					0
Helena.....		0	0	0	0	0	0	0	0	0	0	0	0	0					0
Missoula.....		0	0	0	0	1	0	3	0	1	0	0	0	0					0
Colorado:																			
Denver.....		2	0	3	0	4	0	9	0	12	0	0	0	0					2
Pueblo.....		3	0	0	0	0	0	1	3	0	0	0	0	0					0
Utah:																			
Salt Lake City.....		0	0	0	0	2	0	0	0	1	0	0	0	0					0

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## City reports for week ended Nov. 16, 1946—Continued

Division, State, and City	Diphtheria cases		Influenza		Measles cases		Meningitis, meningococcus, cases		Pneumonia deaths		Poliomyelitis cases		Scarlet fever cases		Smallpox cases		Typhoid and paratyphoid fever cases		Whooping cough cases	
			Cases	Deaths																
<b>PACIFIC</b>																				
Washington:																				
Seattle.....	2	0					0													5
Spokane.....	0	0					0													2
California:																				
Los Angeles.....	8	0	1	0			1		7	6	2	0	0	0	0	0	0	0	1	
Sacramento.....	0	0		0			0		0	2	0	0	0	0	0	0	0	0	0	
San Francisco.....	3	0	1	0			1	0	6	1	4	0	0	0	0	0	0	0	3	
Total.....	93	2	43	13			355	31	309	151	441	2	7						650	
Corresponding week, 1945.....	77		73	20			460		307		593	0	19						628	
Average, 1941-45.....	91		114	23			325		344		734	0	15						799	

<sup>2</sup> 3-year average, 1943-45.<sup>3</sup> 5-year median, 1941-45.*Dysentery, amebic.*—Cases: New York 3; Chicago 2; Detroit 1; Los Angeles 1.*Dysentery, bacillary.*—Cases: New York 1; Philadelphia 1; Charleston, S. C., 1; San Antonio 4; Los

Angeles 3.

*Dysentery, unspecified.*—Cases: Wilmington, Del., 1; San Antonio 8.*Tularemia.*—Cases: St. Louis 1.*Typhus fever, endemic.*—Cases: Charleston, S. C., 1; Atlanta 1; Savannah 1; Mobile 1; Little Rock 1; New Orleans 13; Dallas 1; San Antonio 1.

Rates (annual basis) per 100,000 population, by geographic groups, for the 85 cities in the preceding table (estimated population, 1943, 34,102,900)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza	Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates	
			Case rates									
New England.....	10.5	0.0	5.2	0.0	81	2.6	31.4	28.8	94	0.0	0.0	298
Middle Atlantic.....	8.3	0.0	6.5	0.0	64	4.2	48.1	16.2	55	0.0	0.5	59
East North Central.....	11.0	0.0	4.3	1.8	50	3.1	46.6	20.9	96	1.2	0.0	190
West North Central.....	24.1	0.0	0.0	6.0	8	2.0	46.3	56.3	99	0.0	0.0	28
South Atlantic.....	13.2	0.0	18.2	3.3	129	3.3	46.3	13.2	58	0.0	1.7	96
East South Central.....	29.5	11.8	5.9	17.7	18	5.9	59.0	17.7	47	0.0	5.9	30
West South Central.....	25.8	0.0	8.6	5.7	17	11.5	54.5	57.4	32	0.0	11.5	26
Mountain.....	49.6	0.0	24.8	0.0	74	0.0	115.6	24.8	124	0.0	0.0	17
Pacific.....	21.4	0.0	3.3	0.0	7	13.2	37.8	14.8	18	0.0	0.0	18
Total.....	14.3	0.3	6.6	2.0	54	4.8	47.4	23.2	68	0.3	1.1	100

## TERRITORIES AND POSSESSIONS

## Puerto Rico

*Notifiable diseases—4 weeks ended November 2, 1946.*—During the 4 weeks ended November 2, 1946, cases of certain notifiable diseases were reported in Puerto Rico as follows:

Disease	Cases	Disease	Cases
Chickenpox.....	11	Syphilis.....	207
Diphtheria.....	51	Tetanus.....	9
Dysentery, unspecified.....	3	Tetanus, infantile.....	1
Gonorrhea.....	130	Tuberculosis (all forms).....	709
Influenza.....	106	Typhoid and paratyphoid fever.....	26
Malaria.....	529	Typhus fever (murine).....	8
Measles.....	4	Whooping cough.....	100
Poliomyelitis.....	56		

# FOREIGN REPORTS

## CANADA

*Provinces—Communicable diseases—Week ended November 2, 1946.*—During the week ended November 2, 1946, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox	19	2	147	212	38	17	59	151	645	
Diphtheria	3	4	43	16	4	1		1	72	
Encephalitis, infectious	1									1
German measles	1		2	6	1				5	15
Influenza				4		1			4	9
Measles	194		111	37	33	121	52	71	619	
Meningitis, meningococcus					1	1		1	3	
Mumps	1		14	184	33	70	33	58	393	
Poliomyelitis	2	1	2	43	18	1		1	68	
Scarlet fever	14	4	54	82	11	1	7	11	184	
Tuberculosis (all forms)	1	18	58	45	20	9	16	45	212	
Typhoid and paratyphoid fever			3	4		1			1	9
Undulant fever				4			1		1	6
Venereal diseases:										
Gonorrhea	17	26	190	131	42	24	45	73	548	
Syphilis	5	12	12	90	76	15	12	9	34	265
Whooping cough		6		47	60	10	1	3	3	130

## FINLAND

*Notifiable diseases—September 1946.*—During the month of September 1946, cases of certain notifiable diseases were reported in Finland as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis	17	Paratyphoid fever	782
Diphtheria	1,020	Poliomyelitis	30
Dysentery	20	Scarlet fever	133
Gonorrhea	1,984	Syphilis	542
Malaria	4	Typhoid fever	39

## JAPAN

*Notifiable diseases—4 weeks ended October 19, 1946, and for the year to date.*—For the 4 weeks ended October 19, 1946, and for the year to date, cases of certain notifiable diseases were reported in Japan as follows:

Disease	4 weeks ended Oct. 19, 1946	Total cases reported for the year to date	Disease	4 weeks ended Oct. 19, 1946	Total cases reported for the year to date
Cholera	13	1,198	Paratyphoid fever	800	7,700
Diphtheria	3,820	38,658	Scarlet fever	202	1,673
Dysentery, unspecified	16,369	79,007	Smallpox	5	17,660
Encephalitis, Japanese "B"	24	1,164	Syphilis	7,374	55,277
Gonorrhea	11,931	98,115	Typhoid fever	3,137	38,600
Malaria	2,848	1,23,093	Typhus fever	45	30,753
Meningitis, epidemic	77	1,280			

<sup>1</sup> For the period June 2, 1946, to date.

**REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND  
YELLOW FEVER RECEIVED DURING THE CURRENT WEEK**

NOTE.—Except in cases of unusual incidence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during recent months. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

**Cholera**

*China—Chekiang Province—Wenchow.*—Cholera has been reported in Wenchow, Chekiang Province, China, as follows: October 1–10, 1946, 140 cases, 14 deaths, October 11–20, 1946, 34 cases.

**Plague**

*Bechuanaland.*—Under date of November 25, 1946, 2 cases of plague with one death were reported in Sehitwa, Nganiland, and 9 deaths from plague were reported in Nokanen, Bechuanaland, up to October 22, 1946.

*Ecuador—Loja Province—Celica County—Pindal.*—During the month of October 1946, 13 cases of plague with 1 death were reported in Pindal, Celica County, Loja Province, Ecuador.

**Smallpox**

*Venezuela—Sucre State.*—For the period November 10–16, 1946, 395 cases of smallpox (alastrim) were reported in Casanay and vicinity, Sucre State, Venezuela.

**Typhus Fever**

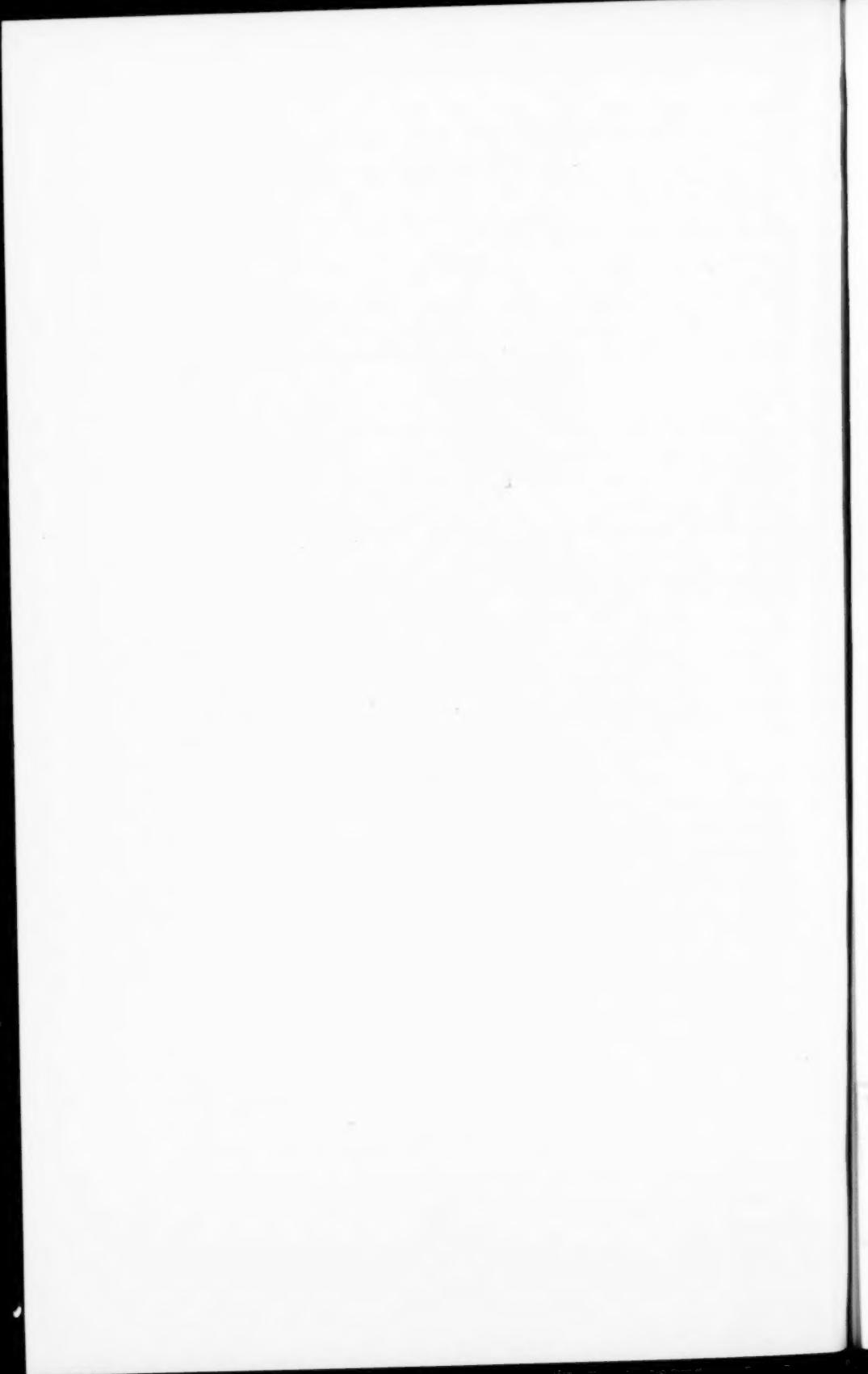
*Ecuador.*—For the month of October 1946, 89 cases of typhus fever with 6 deaths were reported in Ecuador. Provinces reporting the highest incidence are: Chimborazo, 21 cases, 1 death; Bolivar, 18 cases, 1 death; Pichincha, 17 cases, 2 deaths; Azuay, 13 cases.

*Mexico.*—For the month of October 1946, 197 cases of typhus fever were reported in Mexico. States reporting the highest incidence are: Federal District, 49 cases, including 41 cases reported in Mexico city; Oaxaca, 35 cases; Tamaulipas, 21 cases, including 20 cases reported in Matamoros; Durango, 17 cases; Mexico, 13 cases; Nuevo Leon, 13 cases.

*Peru.*—For the month of September 1946, 88 cases of typhus fever were reported in Peru. Departments reporting the highest incidence are: Ancash, 18 cases; Cuzco, 15 cases; Junin, 13 cases; Cajamarca, 12 cases.

**Yellow Fever**

*Ivory Coast—Seguela.*—On November 16, 1946, one case of suspected yellow fever was reported in Seguela, Ivory Coast.



FEDERAL SECURITY AGENCY  
UNITED STATES PUBLIC HEALTH SERVICE

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It contains (1) current information regarding the prevalence and geographic distribution of communicable diseases in the United States, insofar as data are obtainable, and of cholera, plague, smallpox, typhus fever, yellow fever, and other important communicable diseases throughout the world; (2) articles relating to the cause, prevention, and control of disease; (3) other pertinent information regarding sanitation and the conservation of the public health.

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